JUNE 1946

Public Works

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- Collecting 100% of the Water Bills
- Combined Sewage and Garbage Disposal
- Hot Mixed Asphalt in Ohio

PUBLIC ROADS ADMINISTRATION
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Portrait of a Dependable Chemical Feeder

DESCRIPTION

%Proportioneers% Duplex Chem-O-Feeder is a constant rate of feed duplex diaphragm pump with two reagent heads for feeding one or two liquids. The unit is provided with standard "See-Thru" plastic reagent heads and the feed of each pump is manually adjustable while pump is operating by means of stroke length adjustment knob. The mechanism is enclosed in an oil bath and the stroking arrangement is designed for feeding an almost constant stream. This unit is provided with ⅛ HP or ¼ HP motor for feeding against positive pressures of up to 100 lbs. per square inch.

CHEMICALS HANDLED

Calcium and sodium hypochlorite — aqua ammonia — aluminum sulphate — sodium carbonate — lime slurry — caustic — carbon slurry — ferric chloride — ferric sulphate, etc.

SPECIFICATIONS
(per pump head)

Stroke length . . . . . 0 to 0.25"
Delivery per stroke . . 0 to 9.5 cc (at 10 lbs.)
0 to 8.3 cc (at 100 lbs.)
Stroking rate . . 17, 32, 57 strokes per minute
Maximum capacity . . . 8.6 GPH (at 10 lbs.)
7.5 GPH (at 100 lbs.)
Maximum operating pressure —
125 lbs. per sq. inch. for intermittent duty
100 lbs. per sq. inch. for continuous duty
Maximum chlorine feed per 24 hours using 12½% sodium hypochlorite solution . 200 lbs.

TYPICAL USERS

Water Plants (municipal and private) • Swim Pools (municipal and private) • Bottling Plants, Bleacheries • Oil Producers (secondary recovery) etc.

SHIPPING INFORMATION

Net weight . . . . . 110 lbs.
Gross weight . . . . . 140 lbs.
Box size . . . . . 20" x 14" x 18"

% PROPORTIONEERS, INC. %

96 CODDING STREET, PROVIDENCE 1, RHODE ISLAND

26

PLEASANT DREAMS

Every state or county highway engineer . . . every superintendent of streets . . . every contractor . . . every airport maintenance manager . . . can rest contented in the fact that HUBER Road Machinery is the answer to his dreams of low maintenance costs—plus a minimum outlay for equipment to do the job.

The HUBER MAINTAINER—"the one-man maintenance crew" is 8 machines in one—a broom, mower, patch-roller, one-way or V-type snowplow, bulldozer, scraper, and lift-loader.

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INTERNATIONAL HARVESTER COMPANY
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INTERNATIONAL

INTERNATIONAL *Trucks*

VOL. 77 PUBLIC WORKS No. 6

Entered as second-class matter at the Post Office at New York, N. Y., Sept. 1, 1929, under the Act of March 3, 1879.
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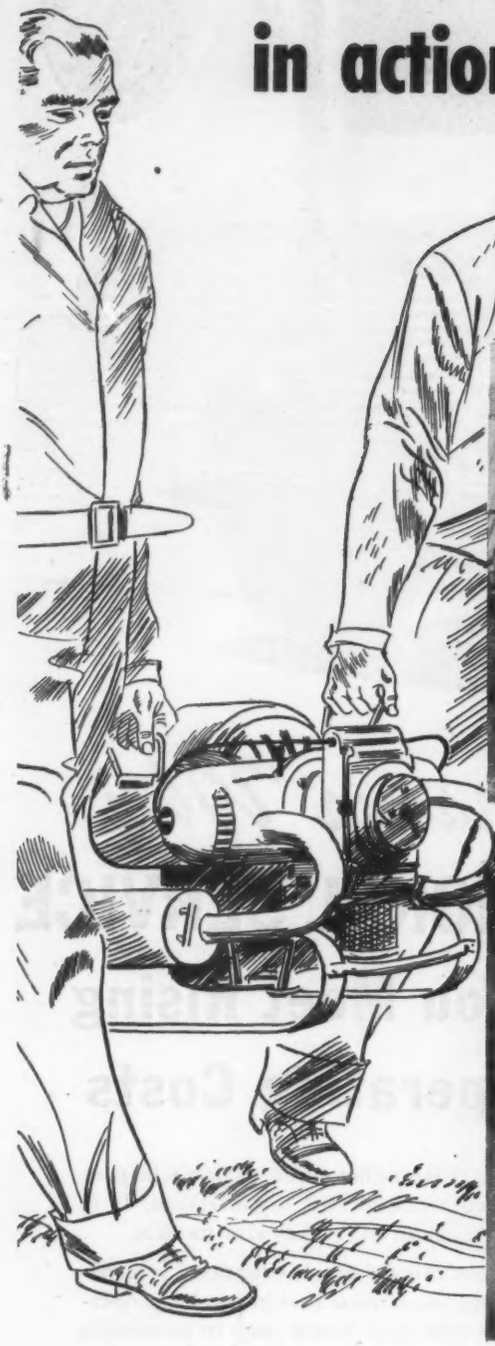
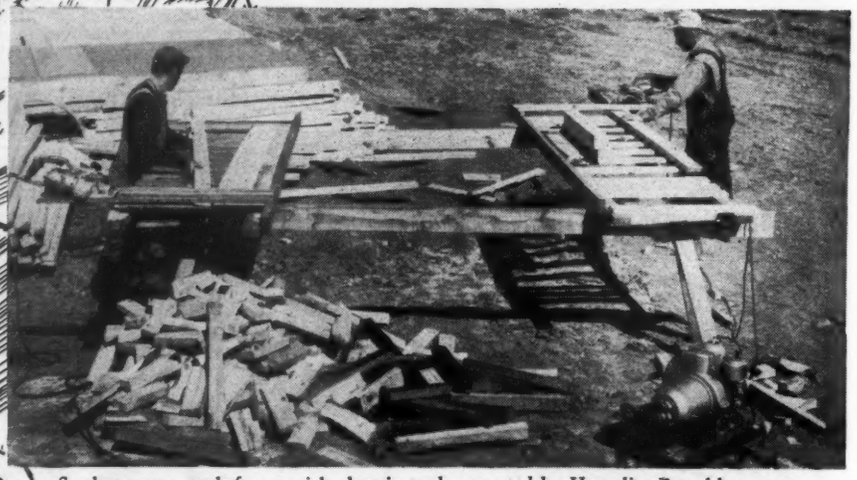
JUNE, 1946

See them in action doing your work on your job





See how men work faster with electric tools operated by Homelite Portable generators. Test the capacity, speedy priming and operational advantages of Homelite Pumps on your toughest dewatering job.

There's only one real way to see how well a Homelite Pump handles large volumes, seepage, mud . . . or how easily a Homelite Generator supplies steady current for floodlights, cost-cutting electric tools, communication systems, etc. That way is to get 'em out on the job. Yes, get these handy portable gasoline-engine-driven units out on *your* job and see how they measure up to *your* standards. See how they work for *you.* All you have to do to get a free demonstration . . . the only way to see in advance what you should get for your money . . . is to write to us today. We'll arrange to have a Homelite Representative see you soon.

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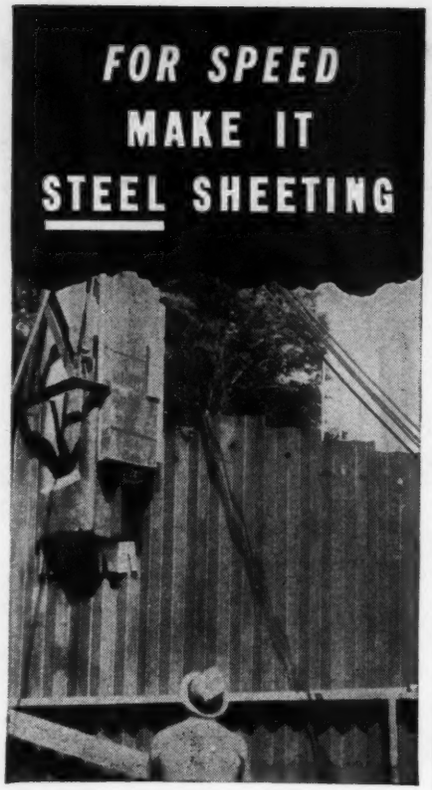
Portable Pumps Generators and Blowers
GASOLINE-ENGINE-DRIVEN



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ARMCO

ARMCO STEEL SHEETING

PUBLIC WORKS

Founded in 1896

Devoted to the interests of the engineers and technical officials of cities, counties and states

Vol. 77 No. 6

W. A. HARDENBERGH and A. PRESCOTT FOLWELL
Editors

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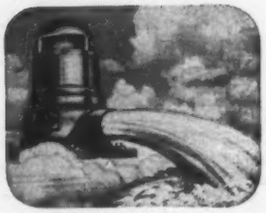
WHEN YOU VISIT MODERN MEXICO CITY



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★ ★ ★ ★ ★✱ ★ ★ ★ ★

In and near Mexico City, you will find many fine, time proven Layne Well Water System installations. A partial tabulation shows Layne Well Water Systems serving Mexico City, an Automobile Assembly Plant, a large Chemical and Pharmaceutical works, Tire and Rubber Companies and extensive Irrigation Projects in the valley of Mexico adjacent to Mexico City. As in the States—and elsewhere throughout the world—these Mexico installations are giving highly efficient and exceptionally dependable service.

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LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

When you need special information—consult the classified **READER'S SERVICE DEPT.**, *pages 63-65*

The Editor's Page

PUBLIC WORKS' Program

Good roads, modern waste disposal facilities, and safe and adequate water supplies are community assets of the highest order. They are essential to the business and social life of the community, as well as to its health and prosperity. To utilize the best and most modern equipment and methods in their construction, operation and maintenance is basic and fundamental common sense. These facilities cost a good deal of money, both to construct and to maintain and operate; they are permanent structures; and they must last a long time. They must be built right in the first place.

Maximum utilization of the benefits of up-to-date techniques and equipment can be attained only through well-trained engineers, who are free from political or other influences that may detract from their ability to serve their community. To attract to, and keep good men in, the public service, engineering salaries must be increased to a point commensurate, at least, with those of other professional men in positions of like responsibility. But larger salaries alone are insufficient to increase the stature of engineers, though they will help very materially. There are needed in addition a clearer definition of what an engineer is, and a steady tightening of requirements for qualification as an engineer. There is also needed a broader program of training for engineers to assure greater initiative, more imagination and a larger willingness to accept responsibility.

These things—more and better community assets to improve living, and a fair and equitable place for engineers, with adequate rewards for ability and responsibility—PUBLIC WORKS stands for, and it will never cease its efforts to attain them. It will continue to publish well-written and authoritative articles specifically designed for these engineers; it will provide aggressive and courageous leadership toward the betterment of engineers and the work they do; and it will never stop trying to do a better job.

It's a Parade Now, and Not a Mass-Meeting

There are more new faces in the public works field than there have ever been before. Some of them are the men who, before the war, were in other lines of work; others are those who had not been out of technical schools long enough before the war to rise above the sub-professional grade. If it takes only three years after graduation to make an engineer, then practically all of the men who graduated since 1938 and who enter the public works field are "new faces." This is on 8-year span; men in this group represent a sizable and, in the years to come, an increasingly important segment of the public works engineering personnel.

There are also many men who have served three or four years in the Army or the Navy, few of whom worked at their specialties during this time. Now they are back, and they want to be brought up to date. This is also a large group; it includes a considerable proportion of the men born since 1900. Taken with the younger men already mentioned, they will dominate state, county and municipal engineering for the next 25 years.

Estimates of the size of these groups vary, but it seems generally conceded that at least 40% of the men now in the public works field falls into these categories. Some believe that the figure will be much higher by the middle of next year. Whatever the details are, there has never been a time when such a large and important group are wanting to learn. They want to make up quickly for the years they have lost; they will not wait.

PUBLIC WORKS has scheduled a series of summarization articles, designed to bring these men up to date in their various fields as quickly as possible. Some of these have been published; others are coming quickly. The wise manufacturer should not wait until 1947 either to begin to tell about products; someone else will get there first. It is time to start right now.

Straw Votes on Equipment Purchases

Will there be enough equipment to meet the needs of the public works field during the next year or so? Some manufacturers report that they are booked to capacity for months; they want no business now. What are the facts? Is all this apparent business "firm."

The Editor of PUBLIC WORKS during the first part of May sent out letters to 50 city engineers, 50 county engineers and 50 water works superintendents asking if they had placed conditional or tentative orders with more than one firm. These men were not specially selected, except that communities were picked where it was known that some work was contemplated.

To date, 95 of the 150 have replied; 58 say they have not placed conditional orders; 31 have placed such orders—in some cases with as many as ten firms; 6 replies were so indefinite as not to justify classification.

While we merely pass on these data, without any particular attempt to interpret them, they do seem to indicate that orders booked in 2, 3, 4, 5 or even 10 places may be a factor in swelling backlogs well above their true volume. We might also add that conversation with a limited number of men at the AWWA convention bore out the figures quoted above.

Worthington-Gamon
WATCH DOG WATER METERS

The meter used by thousands of municipalities in the U. S. and abroad.

SURE TO MEET YOUR SPECIFICATIONS FOR ACCURACY, LOW MAINTENANCE, LONG LIFE

Before you invest in water meters, get acquainted with the design and performance advantages which make Worthington-Gamon Watch Dog Water Meters first choice of so many municipalities and private water companies in the United States.

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"Watch Dog" models . . . made in standard capacities from 20 gpm up; frost-proof and split case in household sizes. Disc type, Turbine type or Compound type. Write for Bulletin.

G6-2

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PUMP AND MACHINERY CORPORATION

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permits Strong, Lightweight, Built-up Construction . . .

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4 CYCLE
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Air-Cooled Power

Case History No. 7

WM. H. SCHNEIDER,
Supt. and Chemist
Water Filtration Plant,
Fremont, Ohio

A SOFTENING PLANT

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"The plant was of a conventional design, employing Lime and Soda Ash for softening and Alum for coagulation. Trouble was encountered in forming a satisfactory floc in the colder months, especially with high turbidities. As the city grew and the demand increased, it was necessary to find a remedy for this condition, and after running laboratory tests indications were that an iron salt would give better results. An old feeder was converted so as to make it possible to run a plant scale test, using FERRI-FLOC.

"The conclusions reached from this plant test prompted our purchasing new feeding equipment suitable for feeding FERRI-FLOC. As a result of this change, we have secured a more satisfactory finished water throughout the entire year.

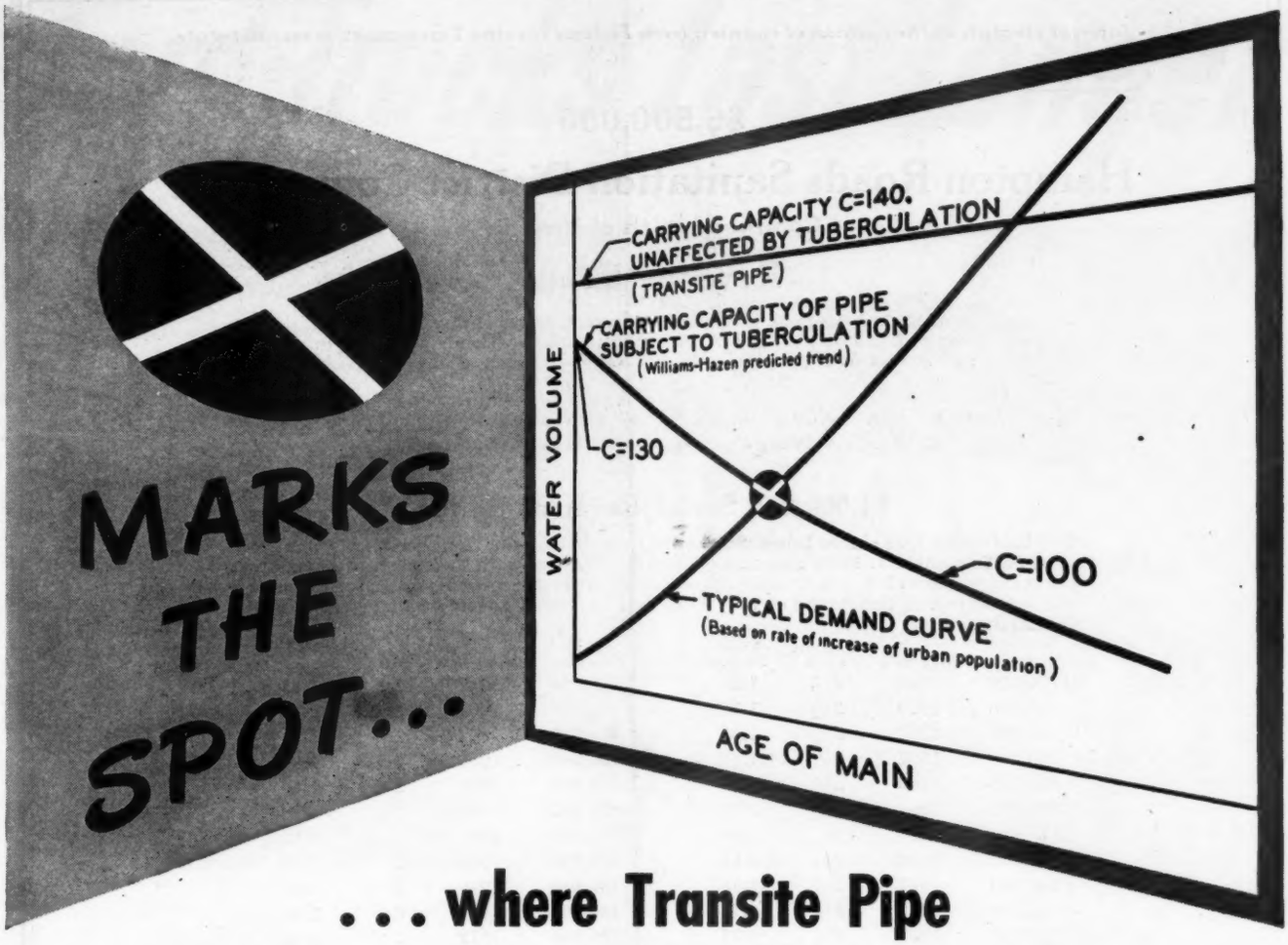
"Our thanks to the Technical Staff of the Tennessee Corporation for their assistance in solving our problem."

(Signed) WM. H. SCHNEIDER

TENNESSEE CORPORATION

Manufacturers of Ferri-Floc

ATLANTA, GEORGIA LOCKLAND, OHIO



. . . where Transite Pipe means extra savings for taxpayers

THE CURVES above help explain why Transite Pipe's high delivery capacity means important economies in the operation of municipal water lines.

The ascending curve is a demand curve which shows the increasing flow requirements imposed on a water line due to population growth. The other two curves are capacity curves for two kinds of water lines. One represents a non-tuberculating Transite line; the other represents a water line in which the pipe is subject to tuberculation.

"X" marks the spot where the carrying capacity of the line subject to tuberculation, progressively decreasing due to this costly form of corrosion, just balances the demand. Beyond this point, if pressures and volume are to meet normal consumption and fire-fighting requirements, pumping pressure must be boosted or the main periodically cleaned. It may even be necessary to line the pipe, reinforce it with an additional one . . . or replace it altogether.

Now note the added period of time during which the Transite line continues to meet demands. Here tuberculation is not a factor . . . can never reduce the line's high initial carrying capacity. Thus Transite's freedom from tuberculation means a longer period of efficient economic service to the community—added savings for the taxpayer!

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Johns-Manville

Transite Pressure Pipe

An Asbestos Product

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Interest exempt, in the opinion of counsel, from Federal Income Taxes under present statute.

New Issue

$6,500,000

Hampton Roads Sanitation District Commission

Commonwealth of Virginia

Revenue Bonds

Dated March 1, 1946. Principal and semi-annual interest, March 1 and September 1, payable at The Chase National Bank of the City of New York. Coupon Bonds of $1,000 denomination, registerable as to principal only, or as to both principal and interest.

National Bank of Commerce of Norfolk, Norfolk, Virginia, Trustee.
Bankers Trust Company, New York, Co-Trustee.

$4,000,000 Serial Revenue Bonds

Due September 1, as shown below. Subject to redemption prior to maturity, in whole or in part, on September 1, 1949, and on any interest payment date thereafter, at redemption prices ranging from 100¼% to 105%, plus accrued interest, depending on maturity of bond and date of redemption, under certain terms and conditions as more fully described in the Official Statement.

Amount	Maturity	Coupon Rate	Yield to Maturity	Amount	Maturity	Coupon Rate	Yield to Maturity
$120,000	1949	4%	1.00%	$155,000	1962	2%	1.85%
120,000	1950	3½	1.15	155,000	1963	2	1.85
125,000	1951	3	1.25	160,000	1964	2	1.85
125,000	1952	2¾	1.40	165,000	1965	2	1.90
130,000	1953	2½	1.50	165,000	1966	2	1.90
130,000	1954	2½	1.55	170,000	1967	2	1.90
135,000	1955	2¼	1.60	175,000	1968	2	1.95
135,000	1956	2¼	1.65	175,000	1969	2	1.95
140,000	1957	2¼	1.70	180,000	1970	2	1.95
140,000	1958	2¼	1.75	185,000	1971	2	2.00
145,000	1959	2¼	1.75	185,000	1972	2	2.00
150,000	1960	2	1.80	190,000	1973	2	2.00
150,000	1961	2	1.80	195,000	1974	2	2.00

(accrued interest to be added)

$2,500,000 Sinking Fund Revenue Bonds

Subject to redemption prior to maturity, in whole or in part, on September 1, 1949, and on any interest payment date thereafter, at 100% and accrued interest, under certain terms and conditions as more fully described in the Official Statement.

$ 750,000 Series A, 1¾% Bonds, due Sept. 1, 1974 @ 100
750,000 Series B, 1⅞% Bonds, due Sept. 1, 1974 @ 99½
1,000,000 Series C, 2 % Bonds, due Sept. 1, 1974 @ 99½

(accrued interest to be added)

We offer these Bonds if, as and when issued and delivered to us and subject to the approval of all legal proceedings by Messrs. Hawkins, Delafield & Wood, Attorneys, New York City, and Honorable Abram P. Staples, Attorney General of the Commonwealth of Virginia.

For information relating to the Hampton Roads Sanitation District Commission and to these Serial and Sinking Fund Revenue Bonds, reference is made to the Official Statement of the Commission and to the Resolution authorizing the Bonds, which should be read prior to any purchase of these Bonds. Copies of such Statement and Resolution may be obtained from only such of the underwriters as are qualified to act as dealers in this State.

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Walter, Woody & Heimerdinger — **J. G. White & Company Incorporated**

May 6, 1946.

Ford Trucks Last Longer

"FORDS CUT OPERATING COSTS . . . BRING NEW SECURITY . . . WIN DRIVERS' APPROVAL"

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"We are now handling twice the number of calls and the men report the ease of operation and the greater sense of security which our Ford units afford. The performance of our Ford equipment has given this department one of the nicest decreases in cost of operation among our various city departments."

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And the new Ford units for 1946 are the finest in Ford history, with 32 important engineering advancements designed to save operating and maintenance costs and to last longer. Call in the Ford Dealers when truck replacements are in order! They have unsurpassed value-per-dollar to offer you!

Ford

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THE FAMOUS V-8 ENGINE, for toughest service, now 100 HP, with NEW steel-cored Silvaloy rod bearings for trebled endurance • NEW Flightlight aluminum alloy 4-ring pistons for added oil economy • Tougher, rust-proofed valve springs • NEW moisture-sealed distributor • NEW coolant-saving radiator closure • Auto-balanced carburetion for still more thrifty power • Servicing simplified still further. And the rugged, thrifty 90 HP Ford six-cylinder engine, for stop-and-go jobs, with many important advancements, available in all except C.O.E. chassis.

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FORD TRUCKS

MORE FORD TRUCKS IN USE TODAY THAN ANY OTHER MAKE

ADVANTAGES OF PRESTRESSED CONCRETE CYLINDER PIPE • NO. 2

....In all Sizes

● The Lock Joint Pipe Company is now prepared to supply Prestressed Concrete Cylinder Pipe in sizes from 16" to 84" diameter—and even larger—for high pressure pipelines.

Prestressed Concrete Cylinder Pipe retains the fundamental principles of Lock Joint design in having a continuous welded steel cylinder with steel joint rings forming bell and spigot ends with a rubber gasket as a sealing element. The cylinder is lined with a substantial thickness of concrete and after proper curing is spirally wound with high tensile wire under tension.

This method of design makes available pipe in all sizes for higher range of heads with the same economy of first cost and maintenance which Lock Joint Pressure Pipe has always effected. That's one of the reasons you'll find Prestressed Concrete Cylinder Pipe an ideal product for your water supply and distribution mains and oil or gas transmission mains.

LOCK JOINT *Reinforced Concrete* PRESSURE PIPE

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

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Established 1905

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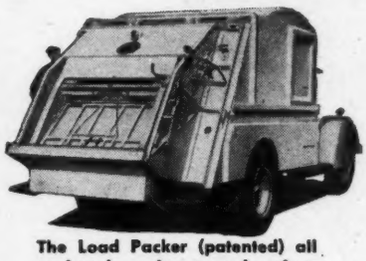

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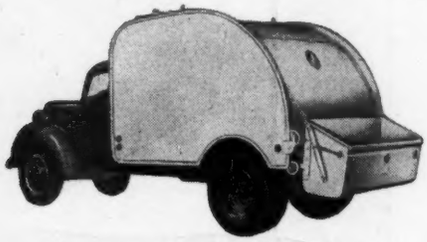

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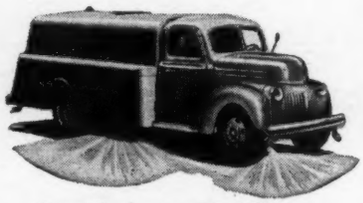

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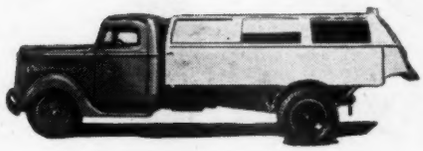

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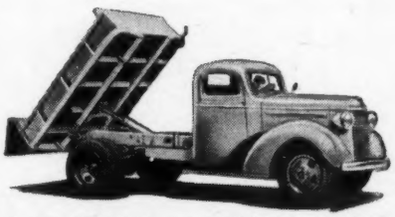

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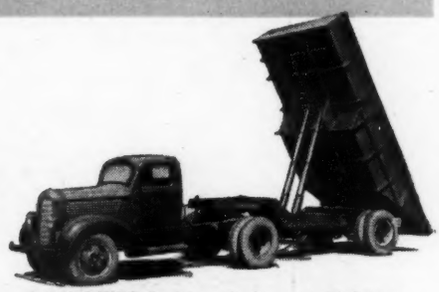

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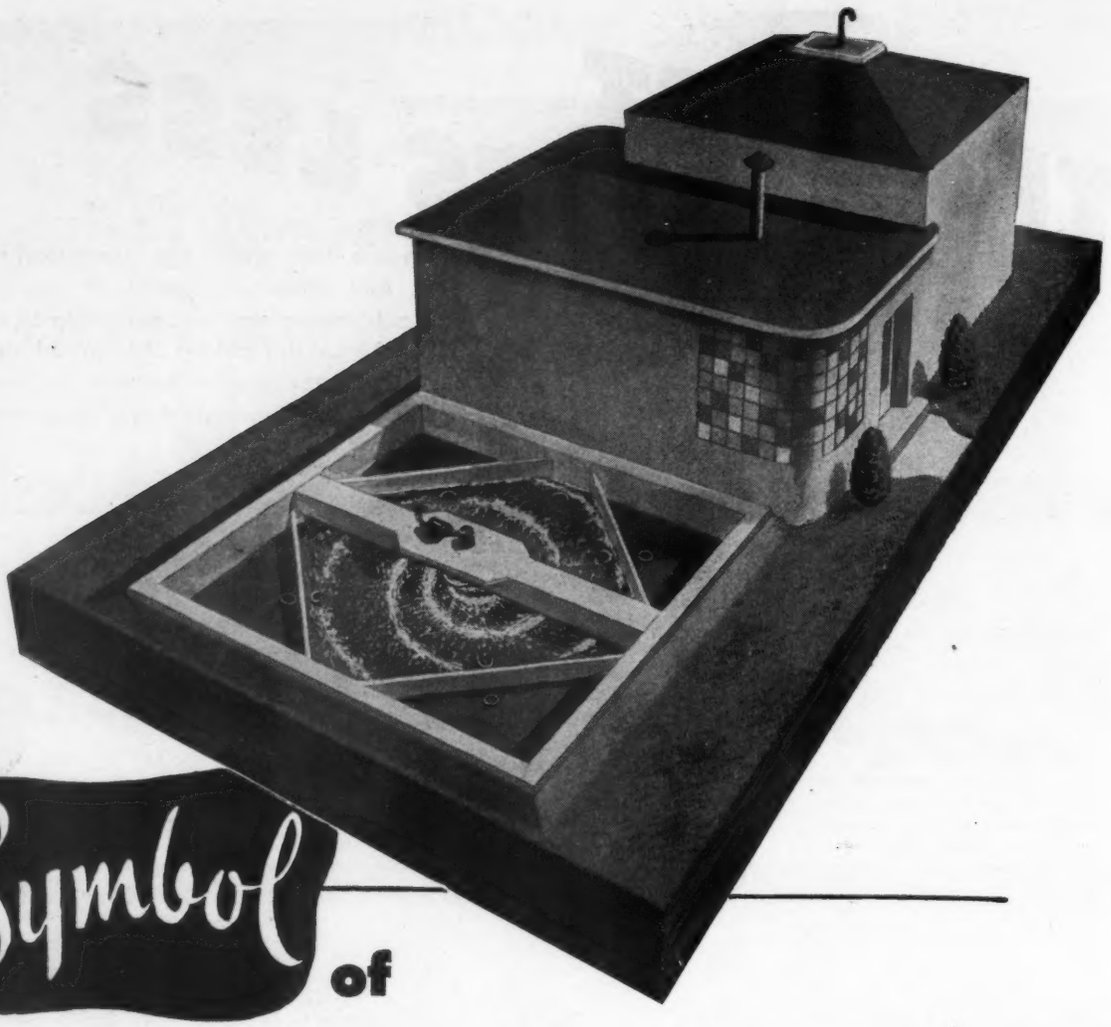

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PUBLIC WORKS MAGAZINE . . . JUNE, 1946

VOL. 77. NO. 6

The Water-Carriage Method of Garbage Collection and Disposal with Sewage

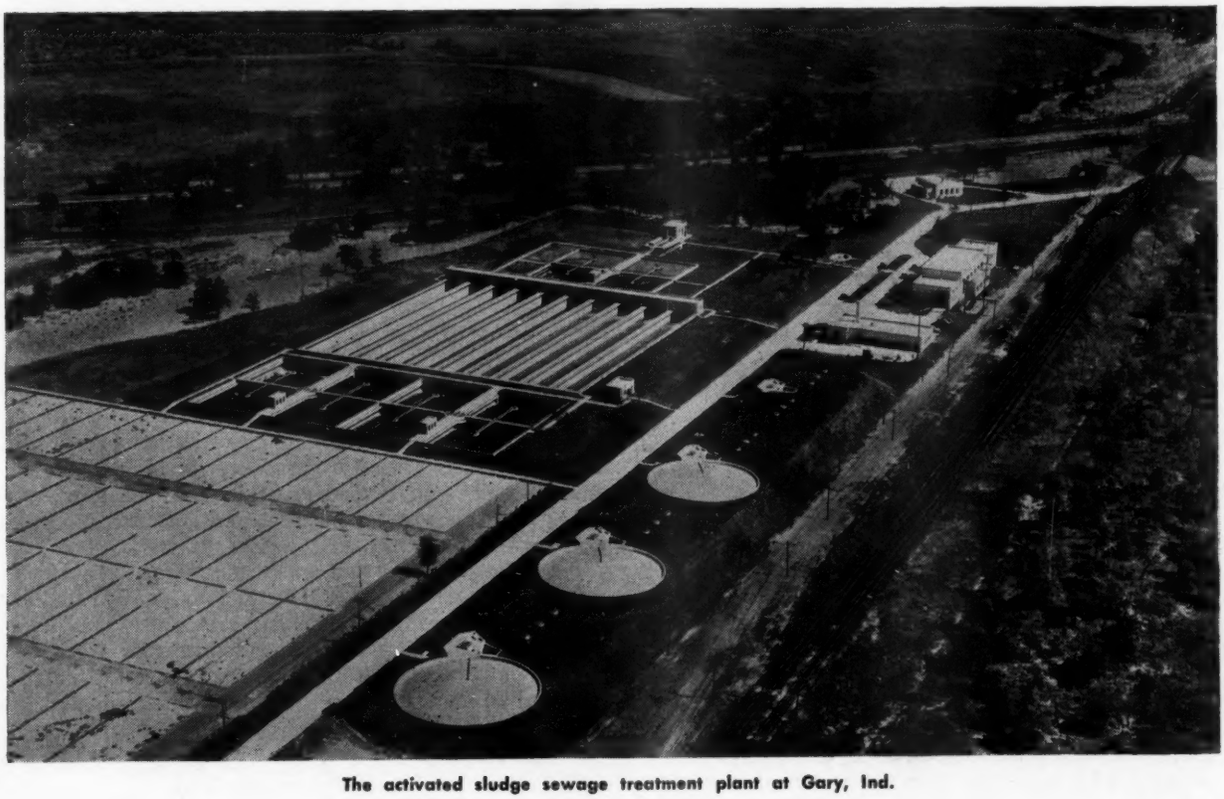
By HAROLD E. BABBITT

Professor of Sanitary Engineering, University of Illinois

IT has been shown by test and by experience that the organic matter in waste food, when ground and mixed with sewage, has similar physical, chemical, and biological characteristics to those of the sewage solids with which it is mixed, in so far as the abilities of the sewer to carry it and the ability of treatment methods to dispose of it are concerned. It seems to make no difference to the sewers or to the treatment process whether "the carbon, the oxygen, the hydrogen or the nitrogen, and sometimes sulphur and phosphorus" of the organic matter in waste food has or has not passed through the alimentary tract of man or other animal. All that is demanded is that the solid materials be macerated so that they can be relatively easily dissolved or suspended in water, and can be more easily attacked by bacteria. The fact that there is no important difference between digested and undigested waste food in sewers and in sewage treatment plants is of primary importance in the consideration of the disposal of garbage into sewers.

Garbage disposal with sewage may be accomplished: (1) By installing waste food grinders in the home, restaurant, or other domestic establishment, and discharging the ground material, mixed with water, into the plumbing; (2) By the installation by the municipality of central grinding stations to which garbage is hauled, and from which the ground material is dumped into the sewer; or (3) By hauling the garbage in trucks, or other vehicles, to the sewage treatment plant, where the garbage is ground and discharged into digestion tanks.

The first method, in which individual food grinders are used by the garbage producer, is the most popular because of its convenience in the kitchen, the bypassing of the garbage pail, and the elimination of the garbage collector from the premises. It is the only complete method whereby water-carriage collection is substituted for dry methods. Despite fears to the contrary, tests and experience show that instead of being conducive to the clogging of plumbing the



The activated sludge sewage treatment plant at Gary, Ind.

passage of waste food through the sewer pipes tends to clean them. Pieces of pipe have been removed for examination from homes containing waste food grinders. The inside surfaces of these have been found to be clean and smooth, contrary to the usual appearance of the inside of such pipes not carrying ground waste food, which pipes are commonly lined with a greasy coating, possibly protective against corrosion, possibly harmless, but nevertheless conducive to clogging. The householder need not fear that the discharge of ground garbage into his plumbing will clog his pipes.

The alert superintendent of sewers may be concerned about the effect on his sewers of so much settleable organic matter, particularly grease, in the sewage. In order to avoid any possibility of trouble he may wish to prohibit the installation of garbage grinders. Before doing so he should investigate the accumulated experience with such devices, the attitude of users, and the potential service and economy to the community which waste food grinders give. Sewers were conceived for service. The municipal sewer department was created to maintain and to operate the sewers. The more service sewers can offer, the greater their value and the more persons are employed in the sewer department. The slogan of the sewer department should be "More and More Serviceable Sewers", not "Hold the Line Against Sewer Service."

Nevertheless some attention must be paid to possible hazards to the sewers and those that are already overloaded must not be abused to the detriment of continued service. Grease seems the greatest threat to successful sewer operation. The probability that the increased amount of grease in waste food will cause difficulties in sewers already susceptible to difficulties from grease seems high. In municipalities where grease traps are used on house plumbing or house sewers the increase in the grease content of the sewage should be expected to increase the necessity for cleaning such traps. Unfortunately for those who advocate the installation of the water-carriage method for the disposal of waste food, there is no positive evidence that the method does not increase difficulties from grease. However, all of the evidence collected by experience seems to be more or less negative, in that reports by those using the method do not mention the clogging of sewers by grease, or by other constituents in ground garbage. A list of cities in which experience has been reported is presented in Table I. It is evident, of course, that since waste food

Table I

Cities With Experience in the Disposal of Garbage With Sewage

Findlay, Ohio (1)*	Lansing, Mich. (6)
Flint, Mich. (2)	Lebanon, Penna. (7)
Fond du Lac, Wis. (3)	Marion, Ind. (8)
Gary, Ind. (4)	Midland, Mich. (9)
Goshen, N. Y. (4)	Rock Island, Ill. (4)
Indianapolis, Ind. (5)	St. Louis, Mo. (10)

*The numbers refer to the references given at the end of this article.

requires water to flush it through plumbing and into sewers an additional load is placed on the sewer and that services already overloaded cannot carry the additional load involved. It is possible that the capacity of the sewer, and it is probable that the capacity of the sewage treatment plant, will have to be enlarged.

The grinding of waste food in the home or other domestic establishment, and its disposal, mixed with water, into the house plumbing, offers all of the advantages associated with water carriage collection of garbage. That it is economical for the householder or for the municipality is open to question. That it is a convenience and an added service cannot be successfully disproved.

Municipal economy may be advanced by the collection of garbage in trucks and carrying it to central grinding points where the garbage is ground and dumped into the sewer, or to the sewage treatment plant where it may be ground and discharged into a digestion tank. The number of grinding points to be selected is a matter of economy to be worked out in connection with length of haul, size of sewer, and other local factors.

Size and Capacity of Sewer

The size of the sewer, and the rate of flow in it, required to carry a load of ground garbage must be sufficient to disperse the particles of suspended solids so that they will not touch one another in the suspension. Studies of muds and sludges indicate that concentrations of less than 1 per cent solids in fluids will not be so great as to encourage the deposition of the suspended solids from their supporting liquid. Translated into measurable terms this means that ground garbage must not be loaded into a sewer faster than a rate of approximately 40 tons of garbage per day per million gallons of sewage per day; the rate of loading ground garbage into the sewage should not exceed 1 pound of solids in about 12½ gallons of liquid. Hence, a well-designed 24-in. sewer, flowing half full, may be expected to carry 160 pounds of ground garbage per minute which, if discharged continuously, would amount to 117 tons per day; about the amount of garbage to be expected from a city of 235,000 population.

Where ground garbage is discharged into the sewers the polluting power of the sewage is increased and the sewage must either be treated or the amount of diluting water available must be adequate for the increased load. The hauling of the garbage to the sewage treatment plant where it is digested with sewage sludge offers a method for the final disposal of garbage competing with other established methods, such as incineration, reduction, burial, etc. There is a variation in the intensity of the organic load on the various steps of the treatment process due to the fact that an appreciable amount of garbage solids are soluble and may be carried through incomplete sewage treatment processes. Some data on the solubility of garbage solids are given in Table II.

Table II

Quality of Ground Garbage at Indianapolis[5]
Pounds per ton of green garbage

Total solids	350
Insoluble suspended solids after grinding	260
Oxygen consumed	153
B.O.D.	152
Total organic nitrogen	7.59
Petroleum ether soluble	40.2

The digestion of garbage with sewage sludge produces larger quantities of the same valuable by-products as those resulting from the digestion of sewage sludge alone. These by-products include digested sludge which can be converted into fertilizer or into low grade fuel, or combustible gas available for producing heat or power.

Statistical information on the number of household waste food grinders now installed are not available. It is known, however, that many are in use, that there is a demand for more, and that as soon as they are available the number of installations will be increased. Thus the load on sewers and on sewage treatment plants will also be increased. Municipal officials must be alert to this approaching load and must be prepared to carry it.

(Continued on page 30)

Municipal Practices in Garbage and Refuse Collection

Reports from a sample of 500 cities compared with a pre-war survey, with data on frequency of collection and methods of disposal.

New modern collection units for Louisville, Ky.

METHODS and practices in garbage and refuse collection and disposal were reported to the Editors of PUBLIC WORKS during the past few months by 1029 city engineers and other technical officials. The first 500 of the reports received have been tabulated to give a cross-sectional picture of the effect of the war on garbage and refuse practices. The data here presented should be read in comparison with the most complete pre-war surveys ever made—those reported in the February and June, 1940, issues of PUBLIC WORKS—which included more than 2200 cities. The communities reported in the 1946 survey are generally of over 4,000 population and compare more closely with those reported on in the June, 1940, issue.

HOW GARBAGE IS DISPOSED OF

State	No. Cities Reporting	Incineration	Sanitary Fill	Fed to Hogs	Burial	Dumps: Open	Dumps: Covered	Dumps: Burned
Alabama	4	..	1	..	..	1	..	2
Arizona	1	..	..	..	..	..	..	1
Arkansas	1	..	..	..	..	1	..	..
California	24	..	5	14	..	1	1	3
Colorado	10	..	..	7	1	..	..	2
Connecticut	7	3	..	1	1	2	..	..
Dist. of Col.	1	..	..	1	..	..	..	..
Florida	13	2	1	3	..	3	..	4
Georgia	6	1	1	..	..	3	..	1
Idaho	3	..	..	1	..	2	..	..
Illinois	21	6	4	6	..	2	..	3
Indiana	15	2	..	7	2	4	..	..
Iowa	12	1	2	4	1	3	..	1
Kansas	12	..	1	8	..	1	..	2
Kentucky	2	..	1	..	..	1	..	..
Louisiana	1	..	..	..	..	..	..	1
Maine	3	..	..	2	..	1	..	..
Maryland	2	..	..	..	..	2	..	..
Massachusetts	11	..	..	11	..	..	..	..
Michigan	17	2	1	10	1	..	..	3
Minnesota	26	5	..	6	1	5	5	4
Mississippi	4	..	2	..	..	2	..	..
Missouri	9	..	..	5	..	4	..	..
Montana	4	..	..	..	..	..	..	4
Nebraska	2	..	..	..	..	1	..	1
Nevada	2	1	..	..	..	..	..	1
New Hampshire	1	..	..	1	..	..	..	..
New Jersey	16	3	3	3	..	7	..	..
New Mexico	3	..	1	..	..	1	..	1
New York	29	8	2	5	3	7	2	2
North Carolina	11	4	2	..	..	4	..	1
North Dakota	4	..	..	..	..	2	..	2
Ohio	28	9	5	9	3	1	1	..
Oklahoma	12	1	1	5	..	..	..	5
Oregon	5	..	..	..	..	1	..	4
Pennsylvania	40	9	3	12	1	8	3	4
Rhode Island	3	..	..	3	..	..	..	..
South Carolina	7	..	..	3	..	4	..	..
South Dakota	3	..	1	1	..	1	..	..
Tennessee	5	1	1	1	..	2	..	..
Texas	19	3	4	1	1	3	1	6
Utah	1	..	..	..	..	1	..	..
Vermont	2	..	..	1	..	1	..	..
Virginia	12	5	..	1	..	5	..	1
Washington	6	..	3	..	..	2	..	1
West Virginia	5	1	..	..	..	1	..	3
Wisconsin	21	5	4	2	1	5	4	..
Wyoming	1	..	..	..	..	1	..	..

Frequency of Collections

Garbage from Residences.—Of 407 (of the 500) cities reporting specifically on frequency of collection, 176 or 43.2% collect garbage from residences once a week. In 1940, 27.7% collected once a week in the summer and 49.2% in the winter. The 1946 replies did not differentiate between winter and summer collections. Twice-weekly collections were reported in 1946 by 44.0% (179 cities) as compared to 46.3% for summer and 36.4% for winter collections in 1940. In 1946, only 9.3% reported three collections a week against 17.0% for summer and 10.2% for winter for pre-war service. Everyday collections were reported by only 3.5% in 1946—very much less than indicated by the 1940 data.

The reductions in frequency of collection are a natural result of the scarcity of labor and of trucks; if anything, they are less marked than might be expected and represent the understanding and appreciation of municipal engineers and officials of the importance of garbage collection and disposal.

A significant change has taken place in the performance of the collection function. In 1946, 51% of these communities reported municipal collection, and 49% private or contract collection, with 457 cities answering the question. In 1940, garbage was collected by city forces in only 36.1% of the communities, by contract in 31.5% and by private collectors in 32.4%. No doubt many cities found that, under the city engineer or superintendent of public works, better and more economical collection was possible in war-time than by private agencies. This magazine believes that this is true also in peace-time.

Refuse from Residences.—It is in the collection of refuse that the most marked changes have occurred. Practically all of the 251 cities that answered this question affirmatively collect with municipal forces, while 118 others report that they do not collect refuse or ashes. Of the 251, 176 collect weekly or less often, and only 75 collect more often than once a week. In 1940, only 50% of the cities collected refuse with municipal forces.

Other Data on Garbage

The amount, moisture content and weight of garbage were not asked for in 1946. The most complete information available to date on these subjects is that contained in the June, 1940, issue of PUBLIC WORKS. There is no doubt that war affected garbage production and characteristics; however, no city should plan

(Continued on page 36)

Trencher excavating for base widening.

Ohio Uses Hot Mixed Asphalt for Surfacing, Salvage and New Construction

Outline of program under way in Ohio; bases of design; testing and laboratory control of paving mixes; bituminous plant requirements; details of construction practices.

By FRED W. KIMBLE

Bituminous Engineer, Bureau of Construction, Ohio State Highway Department

DURING the past few years Ohio has found it necessary, in order to keep existing highways in service, to salvage many miles with hot mixed, hot laid bituminous concrete. This procedure has been equally successful on farm-to-market roads, heavily traveled arterial highways, and city streets. By salvaging existing pavements with hot mix bituminous concrete, traffic is maintained at all times and no lengthy or rough detours are necessary. The investment in the existing pavement is saved and its section and profile restored to a smoother riding surface than existed originally, in many cases. Also the useful life of the resurfaced pavement is often longer than that of the original pavement. This type of paving material has also been used for new construction, to a much less degree, and promises a service behavior that will be long lived and satisfactory. Resurfacing has been placed on traffic bound, macadam, brick, and cement concrete pavements with excellent results. During the past four years approximately 500 miles per year of all types of pavements have been resurfaced.

The salvaging program with hot mixed bituminous concrete often entails other work than just resurfacing. Drainage is corrected, drainage structures extended, narrow pavements are widened, and shoulder widths and ditch sections improved. Drainage work often requires the placing of transverse and lateral underdrains to lower water tables. Structures that have been built with narrow roadways and projecting headwalls are extended to safe widths. Narrow pavements that are inadequate in width to carry present day traffic are widened. Widening of the pavement necessitates, in many cases, widening the shoulders and setting back the ditches.

The economics of such a salvage program becomes apparent for several reasons. Old pavements and bases that would need to be rebuilt at a cost of thousands of dollars per mile can be restored for many more years of service at a nominal cost. In the restoration, the old highway is improved in section and profile to present day standards. The operation, although salvage in nature, affords a long lived serviceable pave-

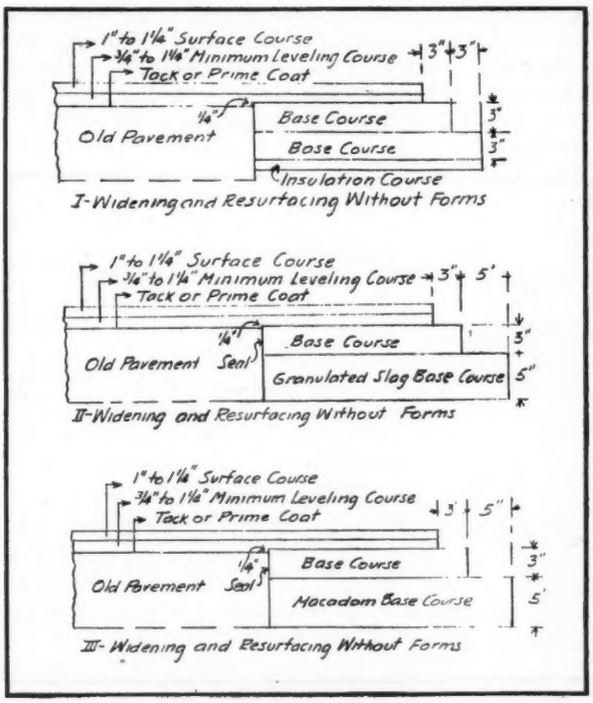
ment. Time, the most important factor in present day travel and commerce, is not lost. The highway is never closed to traffic, there being only short one-way traffic lanes in the immediate area of the salvage work. When the highway is divided lane or of three-lane width, no one-way lane is necessary, and traffic flows unimpeded. The public derives much benefit by not being denied the use of the highway and if this is balanced against the time that would be necessary to close the highway for rebuilding the saving becomes evident and of great magnitude. This advantage was well appreciated during the recent war emergency when an uninterrupted flow of all war necessities was a "must." The smooth uniform texture of a bituminous concrete surface affords benefit to both driver and the vehicle. Wear is reduced on the vehicle, which pays dividends in longer life to the owner. The non-glare, non-skid surface is pleasing to the driver and affords a feeling of safety. Night driving is made safer.

Bases of Design

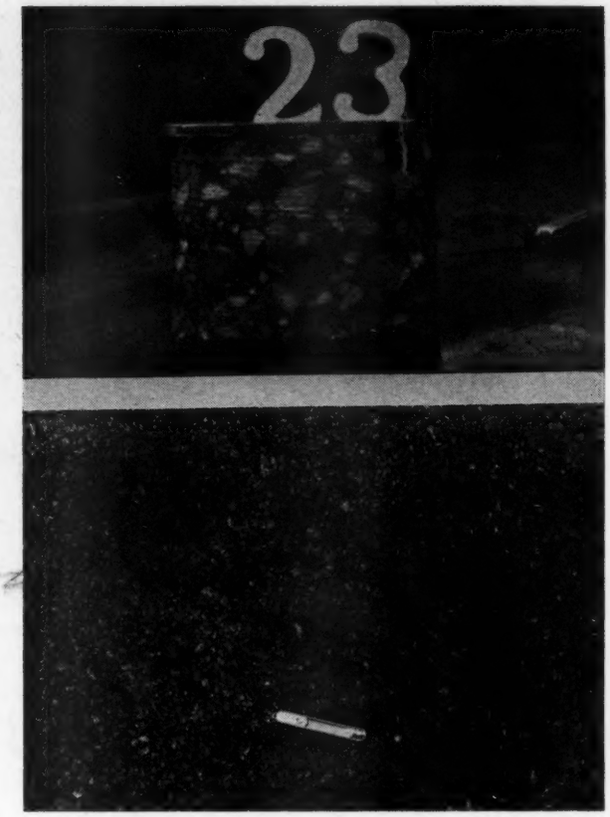
In programming projects for resurfacing or widening and resurfacing the design is based on the individual need of such projects and the availability of local materials. Thickness of mats are determined by the condition of the existing pavement or base and the amount of traffic carried by the highway. Traffic density also determines the penetration of asphalt to be used in the mix. In areas where suitable stone is available, bases for widening are constructed of macadam. In other areas granulated slag bases for widenings have been used successfully. The commonly used sections for salvage work in Ohio are shown herewith.

Fine-textured mixes are used with a 1" surface course while 1¼" surfaces are laid with the coarser textured mixes. In some isolated cases 1½" surface and leveling courses are laid over badly broken and weakened pavements. Depth of leveling courses vary as individual projects justify, the condition of the old base or pavement determining the depth used.

Often when resurfacing is done on curb or municipal sections, the curb height is such that it is not possible to carry the full thickness of the resurfacing to



Widening Data and Methods.



Top, typical core; below, surface texture of T-35 type.

the curb. If this were done the resulting gutter would be too shallow to carry storm water falling on the pavement. To relieve such cases the leveling course is feathered about 3 feet from the curb and only the surface course is carried to the face of the curb.

Testing and Laboratory Control

The Testing and Research Laboratory of the Ohio Department of Highways determines the job mix formula and inspects the manufacture of mixtures for all plant-mix bituminous concrete. All projects are considered individually, although aggregates from the same source may have been used many times previously. Before any project starts samples of the aggregates to be used are submitted to the Laboratory. The samples are tested for grading and other requirements. Also the highest density combination of the coarse and fine aggregate is determined by a vibratory machine. From these data the job mix formula is determined. The asphalt content is always set at the maximum consistent with the absorption of the aggregate and void space in the mix after placing and compacting. The densest combination of the aggregate particles is always sought and care is taken not to overfill the void space with asphalt cement, which might impair stability in the completed mat and produce a slippery surface. Since mixes are manufactured at temperatures ranging from 250°F. to 300°F., depending on the atmospheric temperature, special attention is always given to workability in designing the mix. Workability is a very important mix characteristic, because without it a good pavement is impossible. At the start of each project, a specialist in the design and control of asphaltic concrete mixes, goes out from the Laboratory to observe the mix as designed. This man makes any necessary adjustments to make the mix satisfactory on the job. For each paving plant operation there

Road surface before and 3 years after resurfacing.

is a full time plant inspector, who sees that the operation is always in compliance with the specification. The specialist regularly returns to the plant to aid and advise the inspector. By keeping the mix temperature to a minimum, that will allow satisfactory placing of the material, needless hardening of the asphalt cement is prevented and the service life of the pavement is extended.

Gravel, limestone, and slag are used in combination with natural sand or manufactured sand of either limestone or slag in the manufacture of paving mixtures. Various mixes are used for the several courses of the completed pavement. A base mix in which the maximum size stone passes the 1½-inch square screen is used for base widenings over 4 feet and for the base courses of full width new construction. Another base mix in which the maximum size stone passes the ¾" square screen is used in narrow base widenings, 4 feet and under. Binder and leveling mixes are the same composition as the finer base mix. Surface mixes are of three different gradings, the coarser being the same as the binder and leveling mix; the intermediate mix having the coarsest particles passing the ½" square screen; and the finer mix having the coarsest particles passing the ⅜" square screen. For a greater part of the work, which is on rural highways, only one mix is used. This is the mix with the maximum size particles passing the ¾" square screen. The composition of this mix is shown in the following table, and is the master range of limits within which mixes are designed for various aggregates and sands. Wide range in bitumen content accommodates all combinations from gravel and natural sand to slag and slag sand. This mix is designated as T-35 type "A" in Ohio specifications.

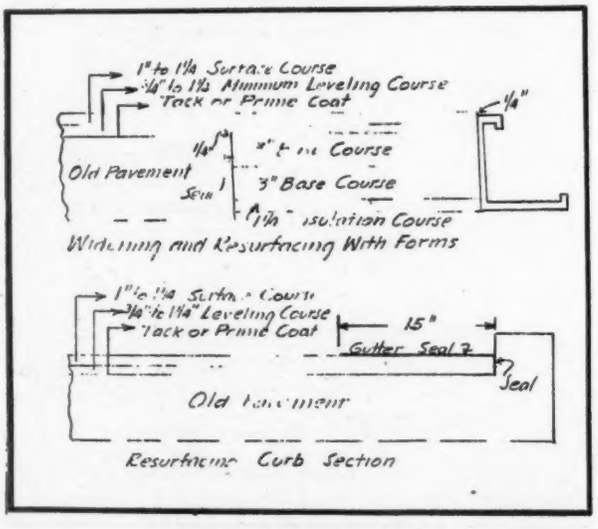
Passing Sieve	*Retained on Sieve*	*Percent Minimum*	*Maximum*
1 inch	¾ inch	0	5
¾ inch	½ inch	5	20
½ inch	⅜ inch	7	30
⅜ inch	No. 4	10	35
No. 4	No. 6	0	10
No. 6	No. 50	20	45
No. 50	No. 200	3	15
No. 200		0	5
Bitumen		5	9.5
Total Retained on No. 6		50	60

From an operational standpoint the use of one mix throughout a project is very advantageous. There are no delays in change-overs at the plant, and construction is simplified. On the job it is not necessary to figure exact quantities ahead of various mixes to fill in spaces of various courses; and base, binder, and surface course operation can be carried on simultaneously, or a rapid change from one to the other can be executed. It is also possible to secure greater density in narrow base widenings with the finer mix and to do a more satisfactory job when widening without the use of side forms.

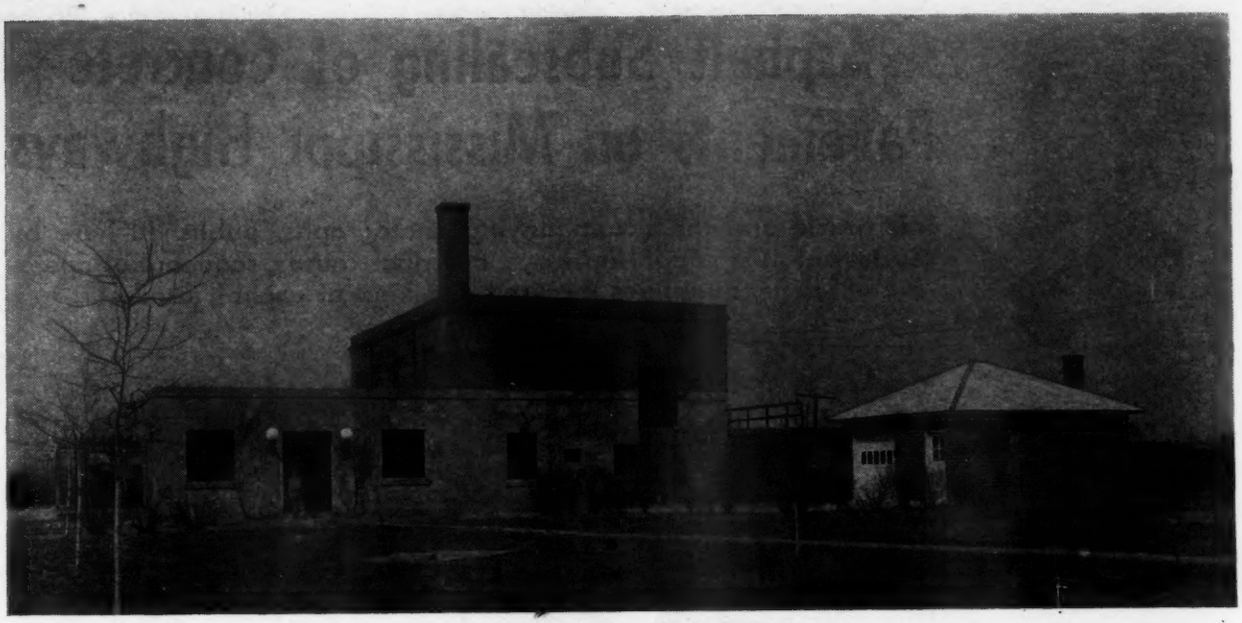
Bituminous Plant Requirements

Bituminous plants used in Ohio are of the stationary batch type. All plants are required to meet rigid specification requirements, and to be kept in good repair and operating condition. Plants are required to be equipped with sufficient storage facilities for both bitumen and aggregate. They must have a feeder for the aggregate with accurate and separate adjustments for separate and proportional feed and be capable of being locked in any position. The driers are required to agitate the aggregates continuously during heating and drying and must permit the temperatures to be positively regulated. The screens may be of shaker or vibrating type, or revolving double jacketed type, capable of satisfactory performance at maximum plant production. The bins must have hot storage capacity sufficient to furnish the necessary amount of aggregates for the maximum rated capacity of the plant and be divided into four compartments. Each compartment is equipped with an overflow pipe and an individual outlet gate. The weigh box must be of sufficient capacity for a complete batch without leveling aggregate by hand. The supporting fulcrums and knife edges must be so constructed that they will not be easily thrown out of alignment, and must be free from contact from all adjacent parts of the plant. Sufficient clearance must be provided between the bottom of the weigh box and the top of the mixer. The weigh box gate must be such that aggregates are not segregated in discharge and have no leakage when the weigh box is loaded. The plant may be equipped with an automatic volumetric meter or a bituminous material bucket with scales for proportioning the bituminous material. The mixer is of the twin pugmill batch type of not

(Continued on page 32)



Widening data and methods.



The Benton water works filter plant.

Collecting 100% of the Water Accounts in Benton, Illinois

By HERMAN GARNER
Superintendent, Water Department

BENTON, ILLINOIS is a county seat and coal mining community with a population of approximately 8000. Our immediate community had no war work; therefore, we had no appreciable increase in population. The Water Department is municipally owned with 2105 customers as of January 1, 1946, and with a total pumpage of December, 1945 of 19,365,000. A railroad, a small refinery, a dairy, and the Village of West City use 43.8% of the total pumpage.

After deducting the four large users and on a basis of 2,100 services, figuring 3.8 persons per service (the U. S. Census Bureau rates 3.8 persons per family) we have 240,000 customers' days per month and the daily demand per person would be 45 gallons. We are 100% metered and employ one meter reader who reads meters every month and passes all bills (except a few which are mailed) at a total cost of reading and passing bills of 5.9c per meter.

We are able to account for 87.3% of all water pumped. Our Sewerage Department does an unusual amount of flushing of main line and private sewers. We have no way of checking the amount of water used but this flushing is largely responsible for unaccounted water.

Follow Up and Collections

By data with which we are familiar, we are lead to believe that some municipally owned utilities are not making the same effort to collect accounts as would privately owned utilities. I can see no reasonable excuse why municipally owned utilities should not have a clear record in collections of its accounts.

We require a deposit from all customers who are not property owners, regardless of their financial standing or their previous record with the Water Department. A deposit of $3.00 is required for a residence; for business places we check the previous records and require a deposit of two and one half times the average monthly bill.

Our bills are dated on the first of the month and are due and payable on or before the 10th without the penalty of 10% which is added and collected after final due date. I am now speaking of bills dated January 1, 1946. On the morning of January 11 we had 145 outstanding accounts, or 6.4% of our total. On January 16 when we started collections by contact, we had 70 delinquents left, which means that 50% of these delinquent customers had called at the office and paid their accounts with penalties added, leaving 3.3% of our customers for us to contact.

We have practically the same customers on the delinquent list each month; due to this we have prepared a list of their telephone numbers. Checking these numbers, we found that 37 out of the remaining 70 customers had telephones. On January 16, we called all parties available, reminding them that we were under the impression that they had overlooked their water bill for the current month, suggesting they call at the office and pay the account, thus saving us a trip for collection. We always permit the customer to state the time they will be in the office, and this date is marked opposite the customer's name. If they fail to respond on this date, the second call is made soon after, and on this basis, the results are about 98%, leaving about 40 customers to contact personally.

Of these there are approximately 10 who drop in and pay without further contact, leaving 30 to call on

(Continued on page 29)

A. M. White

Asphalt Subsealing of Concrete Pavements on Mississippi Highways

This article and the accompanying photographs, published here by courtesy of *Mississippi Highways*, describes causes, sequence of operations, quantities required and kind of asphalt used.

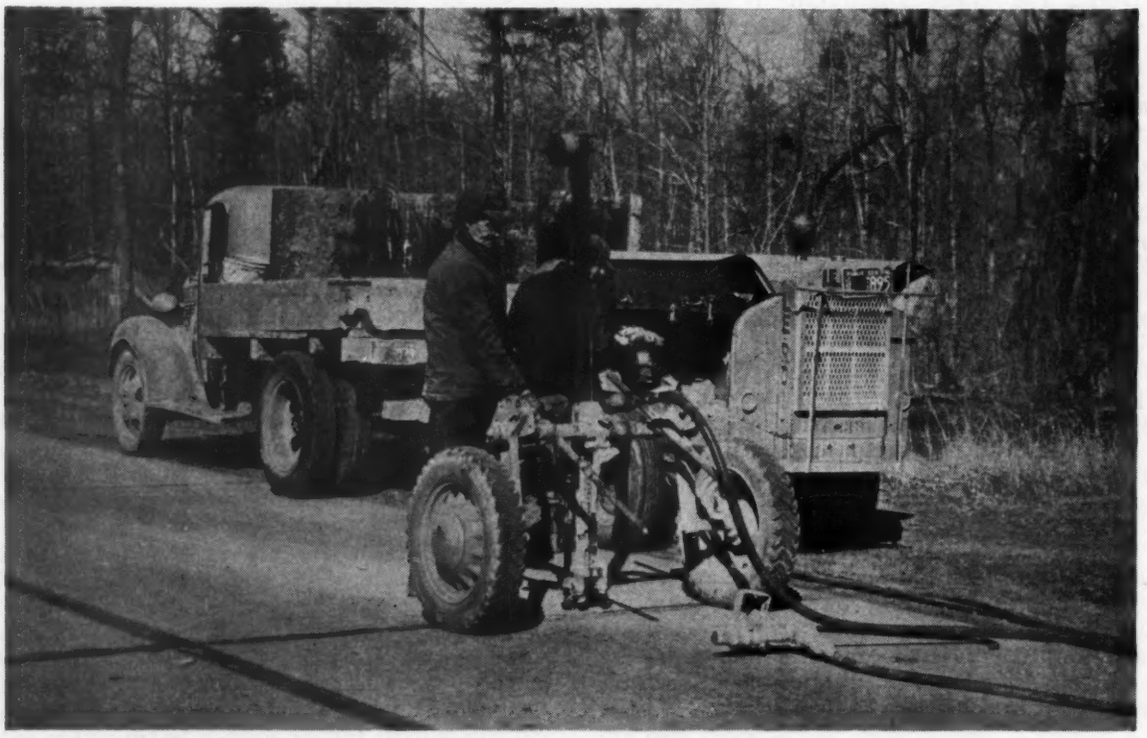
By A. M. WHITE
Assistant Engineer of Maintenance
Photos by Ledbetter

PUMPING of rigid pavements at joints, cracks and along the edge is caused by the deflection of the slab under moving wheel loads which results in the ejection of water carrying soil particles in suspension. As the action progresses, cavities develop in those areas immediately under the pumping slabs, thereby diminishing or removing the subgrade support. When not corrected, this action produces excessive strain on the pavement slab which will eventually cause the slab to break and disintegrate.

Pumping joints may be detected in wet weather by the muddy-water spurt accompanying the passage of heavy vehicles over joints and cracks. After a rain these areas may be easily identified by mud spots on the pavement. In dry weather, pumping pavements usually can be identified by faulting at joints and cracks, particularly where pumping has progressed far enough to lower the forward slab at a joint or crack. One of the signs of a pumping slab is the spalling of the concrete along the longitudinal center joint where one slab has moved up and down against the other slab.

Several other states have conducted experiments to determine the best material to use under slabs to fill the voids and seal the crack or joint from the underside. Ohio conducted a series of tests in 1942 and 1943. Powdered asphalt with a fluxing oil was tried but it was found that this produced a 100 penetration asphalt only; 85-100 penetration asphalt was tried but it was found that after four or five hot days the asphalt would extrude badly from the joints. Next 50-60 penetration asphalt was tried, this also extruded from some of the more open joints. 18-25 penetration oxidized industrial asphalt was tried which seemed to work well in the summer months but after the following winter it was noted that approximately 12% of the joints were pumping again, apparently bearing out the fears that the material became too brittle during extremely cold weather. They then started using an oxidized or blown asphalt having a softening point in excess of 165° and a penetration range of 30 to 45 at 77° F.

The Texas Highway Department ran a series of experiments at Rosenburg during February, 1945, to determine the ability of hot asphalt to fill the voids under the pavement and to expel the free water under the slab. They found that the free water under the slab was driven out as steam or was absorbed as the



Air compressor, wagon drill and blow-out hose.

asphalt completely filled the void. Attempts at blowing out the free water with air were not successful as the air would blow out only enough water to clear a passage.

Equipment Used

A bituminous pressure distributor with one-inch flexible patching hose and tapered steel nozzle is used to pump the asphalt under the pavement. The distributor pump is equipped with a pressure by-pass valve which permits the asphalt to by-pass the pump when the desired pressure is built up (usually about 40 pounds). A valve is used at the nozzle to cut off the flow and prevent leaking when moving from hole to hole. One 105-cu. ft. air compressor and wagon drill are used to drill holes in the pavement for the nozzle. The compressor has an extra air hose with a ⅜ inch pipe on the end to use in blowing out the hole and cleaning out any rocks or dirt so that the asphalt can start flowing. Three 1½-ton trucks with low-side flat beds are used; one to pull the air compressor; one to pull the distributor and one to haul asphalt in drums. The truck which pulls the distributor has a 300-gallon water tank to supply water for wetting the pavement. A large heating tank is used to melt the asphalt in drums before it is pumped in the distributor.

Sequence of Operations

The foreman inspects the pavement after a rain to locate the faulty areas and marks the sections of road to be treated. The air drill operator is instructed as to the location of the desired holes, usually 12 inches from the transverse joint in the center of the traveled lane on the far side when facing in the direction of traffic. If needed, holes are drilled along the center of the road 12 inches from the transverse joint and midway between transverse joints. On some sections of road it was found necessary to drill holes in the center of the traveled way, midway between transverse points. After a few days of experience a good foreman can determine the location of the holes needed.

Wetting the pavement to prevent asphalt from sticking.

Equipment used for forcing asphalt through the hole in the pavement.

The holes used are 2¼ inch to 2⅝ inch in diameter. Smaller holes could be used as the nozzle has a 1" opening. We are using the larger outside diameter of the nozzle in order to be able to use holes previously drilled for mud jack operations.

After the holes are drilled, compressed air is blown in to open up passages for the asphalt and to aid the asphalt in starting to flow. The next step is to pump the asphalt under the pavement at a temperature of 350° to 425° F, using a flexible patching hose, attached to the distributor pump and a tapered steel nozzle. To warm the hose and nozzle, the nozzle is held in the open manhole of the distributor and the asphalt circulated through the hose. This prevents the asphalt from congealing in the hose. The nozzle is then inserted in the drilled hole and asphalt is pumped until it extrudes through a crack or at the edge of the pavement or the slab starts to rise. It has been found that the steel nozzle does not form a tight fit in the hole and asphalt will flow back around the nozzle; also if the joint between the pavement slabs is open the asphalt will squirt up through it. In these cases the crew moves on to another joint and will return after

an hour or two to add more asphalt after the asphalt has had time to cool and seal the joint or form a cushion around the nozzle. Where there is free water under the pavement the hot asphalt will foam, when this asphalt cools it will shrink and leave a void under the pavement. The crew will pump as much asphalt under the joint as they can; then return in three or four hours to pump the joint again. Quite often they put more asphalt under the joint on the second trip than on the first. In some cases it has been necessary to pump the same hole three or four times. After the pumping is finished the hole is left full of asphalt to seal against surface water.

To keep the asphalt which extrudes from the cracks or joints from sticking to the pavement, water is sprinkled around the nozzle and at the joints. A mop does this job very well and does not allow much water to run into the hole. After the spilled asphalt has chilled it is easily scrapped from the pavement with a square pointed shovel.

The asphalt will flow under the pavement into the small voids. In some cases the asphalt has flowed 30 feet to come up through the shoulder of the road or through a crack in the pavement.

Labor, Quantities and Costs

The foreman of the crew should be a man of sound judgment who can plan the work and has had experience in handling asphalt. Previous experience on a mud jack crew is valuable to him in locating the holes for pumping and in raising sunken slabs. One man is required to drill and blow out the holes; one man is required at the heater and four men at the distributor.

The quantity of asphalt to be used is difficult to estimate. If subsealing is the object of the operation from 10 to 80 gallons may be used on each joint. If the slab is to be raised, several hundred gallons may be used at one location. On US 49 in Rankin County south east of Jackson approximately 1500 joints were subsealed and an average of 8.5 gallons of asphalt was used per joint. On US 82 between Leland and Greenville the crew is using from 40 to 75 gallons at each joint.

Due to the fact that we do not have facilities for handling asphalt in tank cars, we order the asphalt in non-returnable 55-gallon metal drums. The drums are peeled off the asphalt which is cut in small pieces and these pieces thrown in the manhole of the distributor. This process is slow and we are supplementing this method by using a 400 gallon homemade kettle to melt the asphalt from the drums and heat it to about 250°F. so that it can be pumped into the distributor.

The crew of six men and a foreman have been pumping from 600 to 1200 gallons in a nine hour day. The crew has not been in operation long enough to give a good indication as to the unit cost.

We are using our specification asphalt AC-13 which is a blown or oxidized asphalt with a penetration of 40-50 at 77°F. and a flash point above 500°F. When we order this asphalt we specify that the penetration will be on the low side or as near 40 as possible. This asphalt is the same asphalt that we use for pouring joints in concrete pavements. Blowing or oxidizing asphalt lessens the tendency to become brittle in cold weather.

Safety Considerations; General

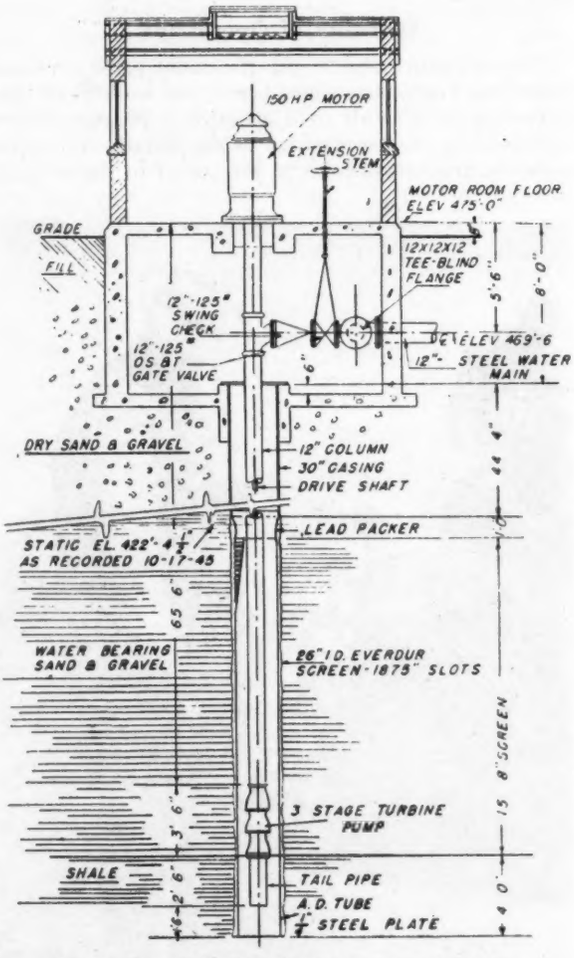
The men who work around the hot asphalt must be equipped with asbestos gloves and the men on the nozzle must wear goggles. Since the crew is working on the traveled surface of the road they must have advance warning signs out and must never step out into the road without looking both ways.

The present method of pumping asphalt under rigid pavement to subseal pumping joints is not by any means in its ultimate state of development. Mixtures of asphalt with a fine filler material (such as loess) or other formulas may be developed which would be more economical. Slab raising by using asphalt is more expensive than when using the mud jack, however where the slab has been mud jacked before and the mud jack material has leached out the use of asphalt will probably offer a permanent cure.

The present practice of obtaining asphalt in drums instead of tank cars is costly and the expense of the additional cost of equipment to handle asphalt in tank cars would soon be offset by the increase in volume of asphalt handled.

Extending Well Into Hardpan Increases Yield

When it became necessary to drill a new well for the Hiram Walker Co. distillery at Peoria, Ill., the well was continued to an additional depth of 4 ft. into the hard-pan underlying the water-bearing strata.



Section of well showing bottom cut into hardpan.

The tail pipe is extended into this cut, which assures a flooded suction intake at all times. The draw-down on this well when pumping at 1500 gpm. is only one foot. B. L. Bailie is plant engineer; the pump is a Pomona 3-stage turbine. The accompanying diagram shows the general arrangement of the installation.

Practices of City Water Departments in Regard to Cross Connections

This is the final installment of the data reported in the March and May issues.

North Carolina.—Twelve replies; two cities inspect regularly for cross-connections; seven require disconnection; one city permits double check valves and one a back-flow preventer. Durham "does not permit cross-connections with other supplies or recirculating systems." Hamlet "does not allow cross-connections of any size," and Raleigh "does not permit cross-connections." Roanoke Rapids reports that "all connections are inspected before being connected."

North Dakota.—Five replies; one city inspects regularly for cross-connections; four require disconnection. Grand Forks reports that "cross-connections are not permitted."

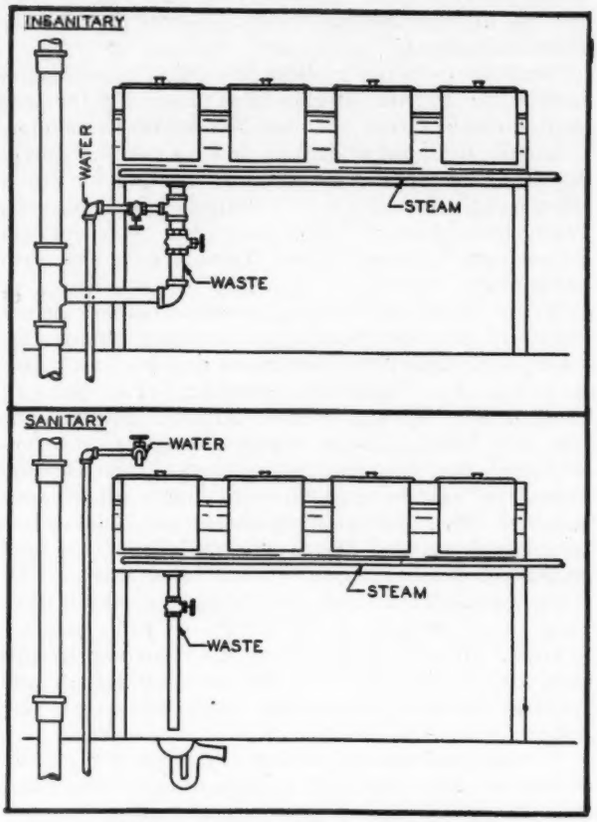
Ohio.—Forty-six replies; twenty-six inspect regularly for cross-connections, one "periodically" and one "occasionally." Thirty-three cities require disconnection; double-check valves are permitted by 12 cities; (Akron states that neither double check valves nor back-flow preventers are allowed); one city permits a single check valve and one a back-flow preventer. In Cincinnati double-check valves are used in approved cases only, and the swing elbow arrangement (two unions and a 90° elbow) is the practice on 4" and smaller lines having connections to unsafe or potentially dangerous sources. In Alliance, no cross-connection is allowed on 4-inch and smaller lines having connections to unsafe or potentially dangerous sources. Bryan "does not sanction cross-connections of any kind."

Delaware does "not permit double check valves or back-flow preventers; swing connections—only one source connected at any one time—are used on 4-inch and smaller lines having connections to unsafe or potentially dangerous sources." The cities of Bellevue, Niles, Struthers and Troy "disconnect." "Check valves" are in use on 4-inch and smaller lines having connections to unsafe or potentially dangerous sources in Lockland, and Massillon "severs or removes a section of pipe." Montpelier "recommends that connection be made as required by the State Health Department." New Philadelphia "disconnects and seals." "Swinging connections" are used in Orrville. Springfield uses a "swinging joint" on 4-inch and smaller lines. Toledo requires "positive disconnects." Wooster "requires physical disconnection," and Youngstown "insists on an open connection."

Oklahoma.—Five replies; two cities report that they inspect regularly for cross-connections; two require disconnection; one city permits double check valves and one "back-flow preventers." Pawhuska "doesn't allow the use of devices on 4-inch and smaller lines."

Oregon.—Nine replies; three cities inspect regularly; six require disconnection; one permits double check valves and one single check valves. Eugene states that it "requires open pipes—no connections." In Milton, "we try not to make the connections."

Pennsylvania.—Forty replies; twenty-two inspect regularly; twenty-three cities require disconnection;



Right and wrong steam table hook-up.

double check valves are permitted by seven cities, single check valves by two cities and three require back-flow preventers. Brownsville reports "we have no such connections." In Corry, "high pressure is our protection 105 to 130 lbs. per sq. in." "No cross connections are allowed" by Danville, Meadville, Lansdale, and Phoenixville. "No cross connection" is reported by Franklin. McDonald states that a "physical break is required on smaller lines. Larger problems are considered individually and must be approved by the State Health Department. We have used double gate and double check valves under instructions of the Health Department." In Mount Union "none is required for probable cross connections in homes or other institutions." In Oil City the practice is "double check valves and double gate valves for all cross-connections, regardless of size." Philadelphia states that "connections have to be approved by the Sanitary Engineer." "None allowed ' is reported by Phoenixville. Shaler has "no lines smaller than 4-inch." Shillington "disconnects"; Titusville "doesn't allow check valves or cross-connections"; Wellsboro allows "no connections of this type"; in West Chester, the "break-line empties into tank; repumped from there."

South Carolina.—Eight replies; four cities inspect regularly for cross-connections; five require disconnection; three cities permit double check valves (in

Charleston, double check valves are used only upon approval of the State Board of Health); one city permits single check valves and one permits a back-flow preventer. Columbia reports "no direct connections are allowed, only removable flanged ells or over-the-top tanks." Greer uses "air break." Spartanburg "does not allow cross-connections—controlled by the State Board of Health." Walhalla does "not permit cross-connections under any conditions; it is a State law."

South Dakota.—Six replies, three cities inspect regularly; four require disconnection, and one permits the use of back-flow preventers. Sioux Falls "has no cross-connections."

Tennessee.—Seven replies; five cities inspect regularly; five require disconnection; one city permits double check valves and one "back-flow-preventers." Johnson City reports "double check valves for boilers; for filling contaminated tanks, etc., opening for filling must be 18" above the top of the tank." In Kingsport, "such connections are being broken and tanks and float valves used." Knoxville and Trenton have "no such connections."

Texas.—Twenty replies; seventeen cities inspect regularly for cross-connections, seventeen require disconnection; three permit the use of double-check valves and one of a "back-flow preventer." The cities of Austin, Big Spring, Cuero, Albany, Nacogdoches and Fort Worth "do not permit the use of cross-connections." Bonham uses "double checks," and Denison "air gaps." Graham requires an "open pit between pressure line and questionable supply." Lampasas uses "check valves." "Gate or globe valves" are used in Odessa. Paris states we "cut out." San Marcos "disnects them." Texarkana uses "double checks if they cannot disconnect."

Utah.—Tooele is the only city reporting in this state; it inspects regularly for cross-connections and requires disconnection; single check valves are permitted.

Vermont.—Four replies; one city inspects regularly for cross-connections; two require disconnection; and one permits the use of double-check valves. Newport states "we have no such connections."

Virginia.—Twelve replies; six cities inspect regularly for cross-connections; seven report that they disconnect; five use double check valves. Danville uses "double check valves if another source of supply is available; single check valves when elevated tank is used and no other source is available." Fredericksburg, Harrisonburg and Waynesboro each report "no cross connections," and Portsmouth "does not permit any cross connections with any other water supply." "Check and gate valves" are in use in Marion.

Washington.—Seventeen replies; fourteen cities inspect regularly for cross-connections; fourteen require disconnection but one city said "in some cases"; in Olympia check valves are not permitted, but that an air gap is required. One city uses double check valves, one permits single check valves and four use back-flow preventers. Bellingham "makes frequent tests of the water to guard against pollution, and when found, takes steps to eliminate same." At Chehalis, only 2" cross connections at two condenseries are used occasionally and the pipe is removed when not in use. Kelso, in reply to the question, "What devices do you use on 4-inch and smaller lines having connections to unsafe or potentially dangerous sources says, "in this case I would remove them to a safe zone." Renton reports that they have the "double valve arrangement." "Disconnection" is required by Auburn. In Tacoma, Anacortes and Hoquiam "no cross-connections are permitted"; Seattle states "all cross connections, or possible connections to any water other than the city of Seattle, are disconnected and not allowed." Vancouver reports "we remove a section of flanged pipe that we can drop in in case of an emergency; the valve is also padlocked." A "broken connection" is used in Wenatchee.

West Virginia.—Five replies; three inspect regularly for cross-connections; three cities require disconnection; one permits double check valves. Fairmont "does not allow cross-connections." A "physical separation" is required in Hinton.

Wisconsin.—Thirty-nine replies; thirty cities inspect regularly for cross-connections; twenty-nine require disconnection; one reported "in some instances." Fifteen permit double check valves and one back-flow preventers. In Beloit, "all cross-connections are under the control of the State Board of Health." The cities of Antigo, Appleton, Cudahy, Hartford, Janesville, New London and Racine "do not permit cross-connections." In Baraboo, Delavan, Mayville and Rhinelander, there are "no cross-connections." Clintonville "has no cross-connections with dangerous sources." In Green Bay "double check valves are not allowed; a swivel connection allows only one source of supply at a time." Kaukauna uses "double check valves." La Crosse reports "swing disconnection; the water can be obtained from only one source." Madison "does not permit connections on 4" and smaller lines." Menasha "only allows cross-connections for fire protection, usually 8-inch." Shawano reports "flange fitted connections installed by special permission." Sheboygan requires "complete disconnection by swing joint." Stevens Point and Wisconsin Rapids each "require disconnection."

Wyoming.—Three replies; one city inspects regularly for cross-connections; two require disconnection, and one reports that single check valves are permitted. Cheyenne "has no cross-connections."

Tests of Thin Concrete Surfacing on Australian Highway

The sides of a stretch of bituminous penetration roadway have been experimentally resurfaced with a thin surfacing of fine concrete to test the durability of this type of surfacing under traffic and in the climatic conditions of Adelaide, Australia. The sides of the roadway were cleaned, the surface was washed, and, while still damp, a layer of neat cement was laid at the rate of 3.4 lb./sq. yd. and broomed into the bituminous surface to provide a tack coat. While the tack coat was still wet a layer of concrete comprising equal parts of cement, sand and ⅛-in. screenings by volume was placed and screeded off with rubber squeegees. Just enough water was used to give a workable mix (water/cement ratio 0.96 by volume). The day after the surfacing was completed it was covered with a thin layer of unwashed quarry sand. A further experiment in the use of local materials under existing climatic conditions was carried out using a cement-unwashed sand admixture for top dressing earth footpaths. The footpaths were regraded, a 1¼-in. layer of premixed unwashed quarry sand with 10 per cent cement by volume was laid, and, after screeding, sprayed with sufficient water to percolate to the underside of the top dressing. Details of labour, equipment and costs for both these jobs are tabulated in an article by F. W. Symons in *Indian Concrete Journal* [1945, 19(2)] which was summarized in *Road Abstracts*.

Collecting 100% of the Water Accounts in Benton, Illinois

(Continued from page 23)

at their residence or place of business. Thirty personal calls out of 2,100 customers, is a very good record—so we think—and is achieved only by continually being on the job month after month. We also practice this policy "Be Fair and Firm." If a customer makes a promise, we expect them to keep it, and we intend to do likewise. On January 28, 1946 all bills for the month were paid. We are now well into meter reading and it will soon be time to start the same operations over again.

In the above month we had but one disconnect for non-payment of bill. This customer came in the same day paying his account plus the 10% penalty and a service charge of $1.00, which is made on all disconnects of this kind.

I would like to repeat from our auditor's report at the end of the fiscal year ending April 30, 1945, that for the year we had an income of $59,119.39 with uncollectible water accounts of $4.05 and no delinquent accounts.

This record may not be so perfect each and every month during the year, but over a period of twelve months we would like to call your attention to the report in the above paragraph of which we are proud.

This record could not read as it does were it not for the cooperation of the Mayor and Council. Political beliefs do not enter the Water Department to the extent of demoralizing its service, and if our department does not properly function, it is because of the Superintendent who is responsible for all operations. In our case, from the impounding reservoir to the cash register, he reports to the Mayor and Council but once each month for his activities.

South Milwaukee, Wisc., Also Collects 100% of Its Water Bills

The city of South Milwaukee has been successful in achieving a record whereby all water bills have been collected 100% over a three year period. This has been accomplished by a concerted effort on the part of the city treasurer, with the assistance and full cooperation of the municipal water commission, according to an article by Elmer Welbes, city treasurer in *The Municipality*.

Until three years ago, South Milwaukee found it necessary to place on each tax roll from 350 to 500 delinquent water bills aggregating in amount approximately $5,000. It was finally concluded by the water commission that this had attained too great proportions and was penalizing the property owners in those instances where the delinquent water bills were incurred by tenants. Thereupon the city treasurer and the water commission jointly devised a system to eliminate this situation.

In the beginning a "Notice to Water Customers" was supplied to each water customer reading as follows:

> "Delinquent water bills are a liability and add work and cost to our city government far in excess of the imposed penalties on such bills. Regular payers must pay for the loss.
>
> "The following procedure of collection will be enforced in the future as done by other utilities and cities.
>
> "1. The regular bill is sent as usual.
>
> "2. If not paid at the penalty date a second bill will be mailed with a time limit of 10 days.
>
> "3. Delinquent customers will then receive a STOP SERVICE notice. Unless reasonable, valid explanation is given to the City Treasurer or a method of payment arranged, the service will be discontinued the next day.
>
> "4. The charge for re-opening the water service is $2.00."

The system was then placed in operation. In South Milwaukee, water bills are submitted quarterly and the procedure explained herewith is followed every three months.

Under this plan a "Past Due Notice" is mailed to the customer the day after the penalty date. This shows the various details relative to the overdue bill and it is ordinarily sent to about 250 customers.

After an interval of six days following the submission of the "Past Due Notice" a "Shut Off Notice" is then mailed to the customer if payment has not been received. Ordinarily about 100 of these notices are sent out. This notice is similar to the "Past Due Notice," but carries the additional warning that if the bill is not paid within 3 days the water will be turned off.

In the case of those customers who do not pay upon the receipt of the "Shut Off Notice" a "Turn Off Notice" is delivered by the meter reader, giving them a final period of 24 hours before the water is turned off. Usually this is delivered to about 15 customers and the result is that these bills are then paid immediately.

The experience of South Milwaukee has been that it is usually the same customers who are involved. The city is proud of the fact that the system has worked and actually has resulted in a 100% water collection for the past three years. It has required some effort on the part of the city treasurer, but there has been involved the educational process of convincing water customers that the city means business.

The property owners who previously have had to assume liabilities incurred by tenants have appreciated the efforts of the city to secure a 100% collection. It has likewise saved the city clerk's office the work of placing delinquent water bills on the tax roll.

Samples of the various forms used under this system can be obtained by addressing a request to the city treasurer, city hall, South Milwaukee.

Safety Engineering in the TVA

The Safety Division of the TVA includes in its program the following activities, according to the National Safety Council:

1. Consultation with design and operating units on safety standards, specifications and methods.
2. Specification and approval of safety devices and equipment (passing on the type of safety equipment that these operating organizations should have for their particular hazards).
3. Assistance in placement of personnel in occupations they can perform with safety to themselves and fellow employees.
4. Project inspection leading to recommendations regarding the correction of accident hazards.
5. The detailed investigation of accidents with specific attention to the analysis of causes—fact finding.
6. The maintenance of accident records and compilation of accident statistics.
7. Education of project personnel in locating and controlling accident sources.
8. First-aid training of project personnel.
9. Coordination and appraisal of safety activities.

The Water Carriage Method of Garbage Collection and Disposal

(Continued from page 18)

The load will not come on suddenly, however. It will increase a little every day until the municipality will find itself in the position of the man who aspired to lift a bull by lifting the animal daily as he developed from a calf.

Amount of Water Needed

The minimum amount of water to be mixed with the ground garbage to assure its fluidity in the sewer has been stated. This amount is greater than that needed for flushing the material through the plumbing, in which a loose mush generally will flow satisfactorily. It may be expected that 2 to 3 gallons of water to 1 pound of garbage will flush the solids through the plumbing pipes. It is known that the amount of garbage produced per capita per day lies between 0.5 and 0.75 lb. but no statistics are available on the amount of water used by individual waste food grinders, except as shown in Table III. It is probably greater than the minimum figure given here for flushing requirements. The effect on the quality of sewage has been more carefully studied. Some statistics in this connection are given in Table III, by M. M. Cohn[12] and in Table IV. It has been stated[13] that, in general, if all of the garbage of a community were mixed with all of the sewage the organic load in the disposal of the sewage would be approximately doubled.

Table III

Effect of Ground Garbage on Sewage Quality
M. M. Cohn

Number of Grinders Connected	*Increase in sewage composition and quantity* Suspended Solids %	B.O.D. %	Flow gal/day	Per cent of sewage flow
100	0.5	0.08	500	0.005
200	1.0	0.17	1000	0.010
300	1.5	0.25	1500	0.015
400	2.0	0.33	2000	0.020
500	2.5	0.40	2500	0.025

Table IV

Assumed Average Quantities and Qualities of Garbage and Sewage Produced in North American Cities per Capita per Day.[11]

Sewage	100 gal.
Plain sedimentation sludge	3.3 lb.
Dry solids in sludge	5 per cent
Volatile solids in dry sludge	70 per cent
Garbage	0.5 lb.
Dry solids in garbage	25 per cent
Volatile solids in dry garbage	90 per cent

It was once thought that there was a maximum limit to the ratio of garbage to sewage solids that could be successfully digested. This impression is evident from the trend of some of the conclusions reported in Reference 13. Subsequent research and experience tend to the conclusion that in so far as biological digestion is concerned there is no significant difference between garbage solids and sewage solids. There may be some difference mechanically in that garbage solids are more prone to contain some refuse not properly classified as waste food, such as old food containers, match sticks, and other rubbish, and it will contain indigestible material or material difficult to digest such as egg shells, the paper-thin portion of potato peelings, fruit pits, seeds, nut shells, etc. This material may accumulate in the digestion tank necessitating more frequent cleaning than would be demanded for the digestion of sewage sludge alone. Some experiences along this line have been reported at Lansing, Mich.[6]

An important factor in the successful and economical disposal of garbage by digestion is the collection and utilization of the gas produced. It is to be noted that the total organic load on the sewage treatment plant will be about doubled if all of the waste food from the community and all of the sewage are to be handled at the plant, as compared with the sewage load alone. The effect on the volume of sewage may be expected to be practically insignificant, certainly not more than about 10 per cent of increase. This means that the organic strength of the sewage will be approximately doubled and that the volume of gas produced, and its rate of production, will be about doubled. The quality of the gas will be about the same as is obtained from the digestion of sewage solids. Some gas qualities reported by

Table V

Quality of Gas From Garbage Digestion[16]

Characteristic	*Per cent by volume*
Carbon dioxide	26.15
Methane	54.59
Hydrogen	5.65
Oxygen	1.27
Undetermined	12.34

Malcolm[14] are given in Table V. In the design of the sewage treatment plant provision must be made for the increased volumes of gas, and its utilization.

In the selection of the sewage treatment process to handle ground garbage the manner in which the garbage is conveyed to the treatment plant is a condition to be considered. There is a difference in the effect on the plant if the garbage is carried to it in a truck, is then ground and dumped into a digester, or if it is carried to the plant in the sewers. In the design of sewage treatment plants to handle ground garbage it makes a difference whether only primary treatment is to be installed, or both primary and secondary treatment are to be used. Where garbage is conveyed to the plant in the sewers, the soluble materials, passing through the primary stage of treatment will increase the B.O.D. load on the secondary stage as much as 15 to 20 per cent. Tolman[5] reports that under the conditions of his test where the suspended solids in the raw sewage were increased about 16 per cent by the addition of ground garbage, the B.O.D. increased 12 to 15 per cent, the volume of primary sludge increased 28 per cent, the suspended solids in the primary effluent increased 3 per cent; and the B.O.D. of the primary effluent increased 11 per cent.

Anticipated costs of handling the increased load of garbage solids have been analyzed by Schroepfer[15] who estimates that the additional cost to the Minneapolis-St. Paul Sanitary District will be about 55¢ annually for each home grinder installed. The monetary saving to the owner of the food grinder will probably be negligible or very small since the use of the grinder does not eliminate the need for the occasional visit of the rubbish or ash collector, the cost of power and of water used may be noticeable, and there may be maintenance and depreciation of the grinder to be considered. The

installation of food grinders in the home can be advocated less on the grounds of economy than on the grounds of service, sanitation, and convenience.

To the municipality which provides garbage collection service a saving might be shown if the required increases in cost of sewage treatment can be balanced against the complete abandonment of the garbage collection service. It is probable that the savings in the cost of garbage collection will be realized more slowly than the increases in the cost of sewage treatment so that the net result to the city, as to the householder, may be no financial saving but increased service, sanitation, and convenience. Where only the costs of digesting garbage in preparation for final disposal are compared with other methods of garbage disposal it is to be expected that the conclusions will, in many instances, be favorable.

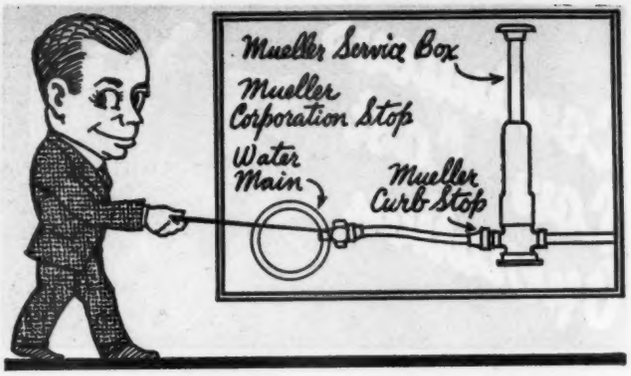
References

1. B. H. Barton, "Extracts from Operation Report, Findlay, Ohio," Sewage Works Journ., 13:976, Sept. 1941.
2. W. A. Kivell, "Trend of Development in Separate Sludge Digestion," Sewage Works Journ. 3:54, Jan. 1931.
3. Jerry Donahue, "Improved Plant Treats Sewage, Tannery Wastes and Garbage," Sewage Works Eng'g., April, 1942, p. 188.
4. S. L. Tolman, "Dual Disposal at Two Midwestern Cities," Sewage Works Eng'g., Nov. 1943, p. 529.
5. S. L. Tolman, "Combined Treatment of Garbage and Sewage—Where Does it Stand," Mun. San., June, 1937, p. 313.
6. Geo. F. Wyllie, "A Year's Experience in Digestion of Sewage and Garbage Solids," Sewage Works Journ., 12:760, July, 1940.
7. C. R. Fox and W. S. Davis, "New Method of Disposing of Garbage," Eng'g. and Contracting, 62:800, 1924.
8. M. M. Cohn, Discussion, Sewage Works Journ., 9:649, July, 1937.
9. Paul Stegeman, "Garbage Disposal in Sewage at Midland, Mich.," Mich. Eng. Exp. Sta. Bull. 95, 18th Annual Conference, Mich. State Sewage Works Operators Ass'n., p. 10.
10. Anon. "Garbage Grinding Plant Installed in St. Louis," Eng. News.-Rec., Jan. 4, 1937.
11. W. Rudolfs, and P. J. A. Zeller, "Effect of Reaction Control on Gas Production from Sludge," N. J. Agr. Exp. Sta. Bull. 486, p. 23, April, 1929.
12. M. M. Cohn, discussion of "The Water Carriage Collection of Garbage" by H. E. Babbitt, Bull. No. 32, Am. Public Works Ass'n., 1945.
13. H. E. Babbitt and others, "The Biologic Digestion of Garbage with Sewage Sludge," Bull. 287, Eng. Exp. Sta. Univ. of Ill., 1936.
14. W. L. Malcolm, "Studies in the Digestion of Ground Garbage," Sewage Works Journ., 9:387, May, 1937.
15. G. J. Schroepfer, Sewage Works Eng'g. October, 1945.

Some Data on the Proposed CAA National Airport Plan

The national airport plan of the CAA contemplates a total of about 6,305 airfields, of which 4,672 will be improved or new construction. The estimated costs for these is $1,021,000,000, of which site grading will cost 525 million, paving 395 million, lighting 55 million and radio 11 million, with 35 million left over for miscellaneous items. The amount spent for paving will be distributed about as follows: For 2,109 Class I fields, $21,892,000; for 1,800 Class II fields, $178,898,000; for 449 Class III fields, $117,928,000; and 242 Class IV fields, $52,955,000; and for 72 Class V fields, $23,633,000.

Most of the 6,305 airfields will be in cities of less than 50,000 population, as follows: Over 50,000 population, 545 fields; 25,000 to 50,000 population, 265 fields; 5,000 to 25,000 population, 1,487 fields; and under 5,000 population, 4,008 fields.



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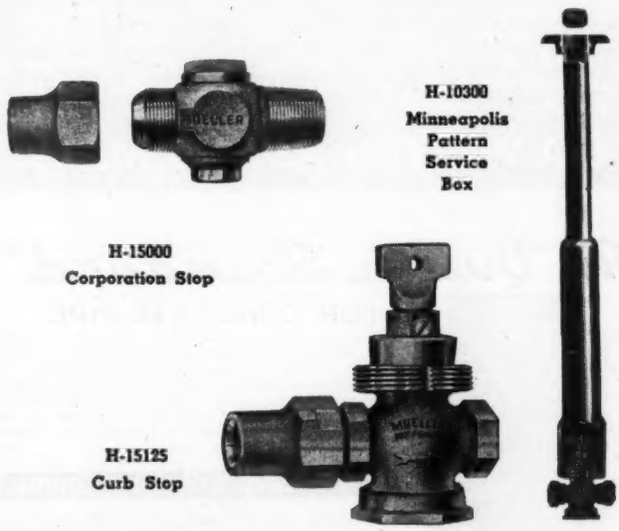

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Ohio Uses Hot Mix Asphalt for Salvage and New Construction

(Continued from page 22)

less than 2,000 pounds capacity. All mixer blades are required to be set in the run around order. Scales for weighing aggregate are required to be of the dial type and scales for weighing bitumen may be either the dial type or scales equipped with a tare and full capacity beam. All asphalt lines, valves, fittings, asphalt bucket, and mixer are required to be steam jacketed. Present specifications do not permit the use of continuous mix plants using volumetric proportioning of aggregate and bitumen. However, the Highway Department has at present one project under contract, on which the plant specification is waived, and on which the hot mix bituminous concrete will be manufactured in a continuous flow plant.

Hot mixtures are transported to the work in trucks having tight, smooth and clean metal beds. The beds must have waterproof covers which are capable of being securely fastened down to exclude all wind. When the atmospheric temperature is under 40°F. or the haul greater than 20 miles the truck beds must be thoroughly insulated. Size of loads vary from 5 to 20 tons. The 20-ton loads are hauled in large semi-trailer trucks. These large trucks are difficult to turn and maneuver into dumping position at the paver. Light oil or a soap solution is used to keep mixtures from adhering to the beds. Some plants are equipped with steam jets, into which a light oil is admitted, which is used for cleaning truck beds and treating them to prevent the adherence of paving mixtures. This latter method has proven the most satisfactory of any in common use.

The second and final installment of this article will appear in the July issue.

Practices in Regard to Sewer Rentals in 190 Cities

At least 190 cities, or 18 per cent of the 1,072 cities over 10,000, now make sewer rental charges, according to *Public Management.* Cities adopting such charges in 1945 include Philadelphia, Pennsylvania; Madison, Wisconsin; Sacramento, California; Upper Darby Township, Pennsylvania; Waco and Tyler, Texas; Xenia and New Philadelphia, Ohio; and Tuscaloosa, Alabama. Cities over 250,000 population rely almost exclusively upon metered water consumption as the basis of the charge. This is a popular method for residential purposes in many smaller cities, but in these cities a fixed per cent of the water bill, a uniform or flat rate to all users, and the number of plumbing fixtures are also employed to a considerable extent. Typical charges adopted in 1945 are: Waco, Texas, makes a charge based upon the number of plumbing fixtures and estimates revenue of $50,000 from this source; Xenia, Ohio, makes a charge of $6 per residence per year, and estimates revenues of $16,000; in Upper Darby, Pennsylvania, the average annual charge per home is $9 based upon the number of plumbing fixtures; and Oelwein, Iowa, estimates revenues of $15,000 based upon water consumption. Sacramento, California, estimates revenues of $168,000 from its new sewage disposal charge which will be added to the water bill at the rate of 25 per cent for residents of the city and 50 per cent for service outside the city limits.

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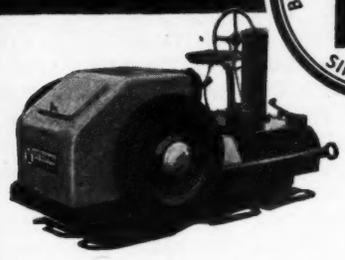

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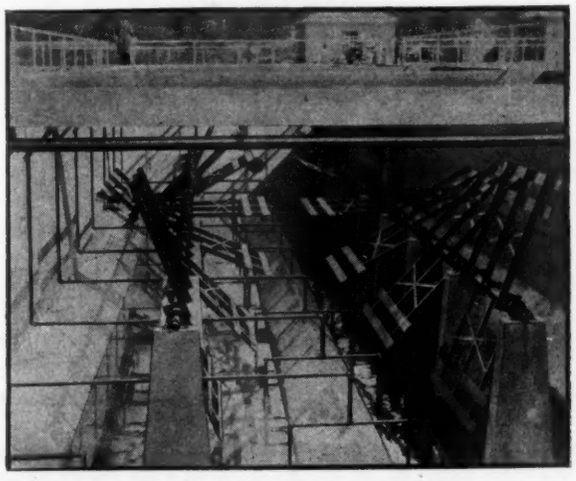

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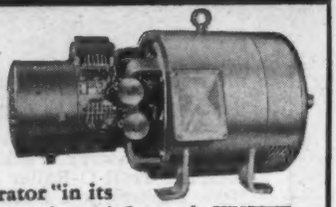

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Monthly and Annual Evaporation Data From Charleston, S. C.

Figures on evaporation from water and land surfaces for the 41 years from 1904 through 1944 are available from the Water Department, Charleston, S. C., of which James E. Gibson is Manager and Engineer. The 1944 report states:

The method of obtaining this evaporation record is as follows: A vessel, approximately 6 inches in diameter is suspended in a second vessel about 2 feet in diameter, immersed and floated in the storage reservoir off shore so that it is subjected to the wind action and the temperature of the water in the storage basin. This is fitted with a hook gauge and every 24 hours an operator measures the quantity of water required to replace the water that has evaporated from the inner vessel. The quantity of water in cubic centimeters required to replenish the vessel is the equivalent in hundredths inches of evaporation.

A similar gauge is located on shore where it receives the wind and sunlight, and is buried in a large fitting filled with earth so as to approximate the ground temperature. This gauge is covered by a glass frame so as to protect it from rainfall. The quantity of evaporation is measured by the quantity of water required to replenish the losses from the gauge.

Record of the reservoir gauge during rainfall is vitiated to a certain extent and at times, due to meddlesome parties, the record on the land gauge is also destroyed.

It is to be noted that the evaporation from the water surface for the period 1904 to 1944, averaged 46.89″ per annum, and from the land surface 79.71″.

The records by months for the 41 years are as follows, in inches of evaporation:

	WATER GAUGE			*LAND GAUGE*		
	Average	*Highest*	*Lowest*	*Average*	*Highest*	*Lowest*
Jan.	2.28	3.49	1.01	4.21	5.98	2.56
Feb.	2.56	4.03	0.69	4.66	7.12	3.04
Mch.	3.77	6.35	1.98	6.80	9.32	4.22
Apl.	4.71	7.04	2.42	7.92	10.79	5.04
May	5.46	7.39	2.83	9.20	13.43	5.12
June	5.34	7.54	2.64	9.06	13.37	4.66
July	5.08	7.35	2.64	8.49	12.98	4.86
Aug.	4.76	7.60	3.13	8.01	12.56	4.70
Sept.	4.27	6.44	2.55	6.92	9.83	4.29
Oct.	3.82	7.01	2.36	5.98	8.54	3.56
Nov.	2.70	4.19	1.67	4.59	6.50	2.90
Dec.	2.14	3.38	1.07	3.87	5.83	2.40

The maximum year's evaporation from the water surface gauge occurred in 1908 and was 65.57 inches. Maximum evaporation from the land surface gauge occurred in the same year and was 110.63 inches. In several cases, evaporation from the water gauge for 3 consecutive months exceeded 21 inches, or about 40% above the average for that period.

Massachusetts Town Installs Emergency Lighting Plant in Town Hall

Belmont, Mass., has installed an auxiliary electric light and power plant in the Town Hall to provide power and light during emergency periods. Power failures caused by winter snows, ice storms, floods and electrical storms have been sufficiently numerous and, in such cases as hurricanes, of long enough duration fully to justify such installations. Thus, in any emergency, the nerve center of the community is equipped to function, irrespective of the power situation. The power unit is a Fairbanks-Morse, 2000-watt, 60-cycle, 115-volt generating set driven by a gasoline engine.

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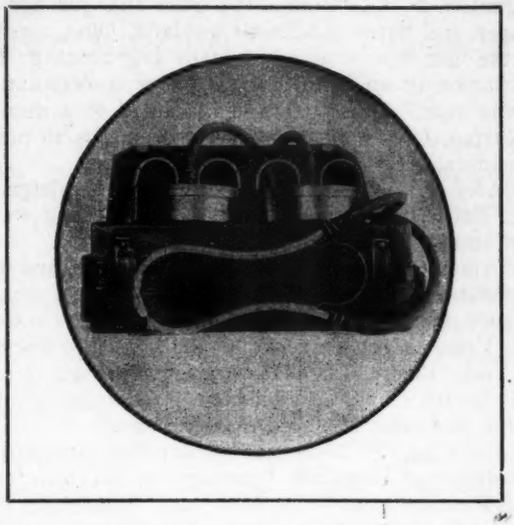

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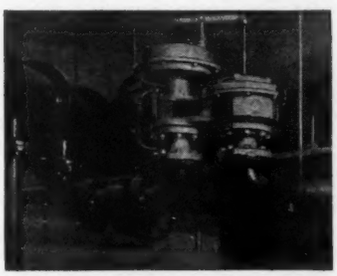

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MUD-JACK METHOD

Garbage and Refuse Collection

(Continued from page 19)

for collection or disposal on the basis of war-time production, characteristics or population. These factors are of academic interest only in respect to future planning.

Wrapping of garbage was reported as required by 122 cities. A large proportion of the cities replying stated that they used covered (119) or water-tight (198) bodies for collecting garbage, but there are no data to indicate the type of bodies used.

Disposal Methods

There are also significant, though less marked, changes in garbage disposal methods. Of the 455 cities reporting on this, 15.6% incinerate the garbage, as compared to 14.6% in the 1940 survey. There was also an increase in sanitary fill to 11.0% as compared to 6.7% in 1940. Only 29.2% fed garbage to hogs in 1946, against 36.0% reporting this method in 1940, despite the war-time need for fats, oils and food. This change may have been partly due to lack of transportation facilities as hog farms must be located far away from any populated area; the probable war-time reduction in food values of garbage may also have been a factor; or perhaps a growing realization of the many objections to this method of disposal. Only 3.2% reported burial, and 40.0% disposal on dumps, as compared to 36.0% in 1940.

Of the 176 cities reporting the use of dumps, 96 stated that they used open or uncovered dumps; 17 used covered dumps; and 63 burned the refuse on dumps. The table herewith shows the different methods of disposal grouped by states. Some comments on disposal methods and problems taken from the questionnaires follow.

Tempe, Ariz., disposes of garbage in the river bottom and also by burning. Most of the wet garbage is fed to hogs and dry material is dumped in Helena, Ark., and in Van Buren it is gathered mostly by local haulers, who do their own collecting. In Chico, Calif., "the garbage is disposed of on an open dump and burned and also used as feed for stock." Chula Vista sells it to a hog farm; and in Laguna Beach and Lynwood it is also fed to hogs. In San Francisco, it is used for fill and covered. In San Jose, some of the garbage is used for sanitary fill but part of it is fed to hogs. Santa Paula "sells the garbage to a hog farm." The "cut and cover method" for disposal of garbage is in use by Stockton, Calif.

In Bristol, Conn., the garbage is utilized by farmers. Glastonbury disposes of it "privately." Reduction is used in Washington, D. C., but some of the garbage is fed to hogs. "It is dumped first for hog feed and then burned" by Lakeland, Fla.

In Canton, Ill., private collectors dispose of the garbage; and the same practice is followed by the cities of Champaign and Clinton. Robinson either "feeds it to hogs or places it on the city dump."

Newcastle, Ind., "sells the garbage on contract." It is disposed of in "pits outside of the city" in Ames, Iowa. Newton, Ia., reports that it is "sold."

In Lansing, Mich., the garbage is disposed of through digestion at the sewage treatment plant. Morganton, N. C., "dumps the trash and garbage in the open and burns it." East Cleveland, Ohio, reports that the 'garbage is disposed of by hog feeding; the construction of an incinerator is under contemplation for this year." The "garbage is hauled to a dump" in Warren, Ohio; and this city also expects to build an incinerator.

McAlester, Okla., reports that "edible garbage is fed to stock and the non-edible is burned," and Pawhuska states "Rental contract with individual."

In Albany, Ore., the "garbage is dumped and the inflammable portion burned in the open." The garbage is disposed of in Catawissa, Pa., by "private collectors." Homer City leaves it "to the hauler to dispose of." York, Pa. reports that "organic garbage is collected by the Chas. C. Fisher Co. (reduction plant), and the inorganic is placed on the dump."

Rapid City, S. Dak. has "controlled dumping." In Columbus, Tex., the "garbage is not collected, monthly clean up of trash cans, etc." Randolph, Vt., states that "householders make their own arrangements with collectors." Rutland, Vt., has private collectors. Marion, Va., reports that the "town dump is used for dry garbage and wet garbage is given to hog raisers."

Clintonville, Wis., uses "tipping in conjunction with reclaiming waste land." In Cudahy it is disposed of "in an open ravine mixed with rubbish." Fort Atkinson "fills in a low area for a future park." Green Bay "buries it or delivers it to farmers." It is used for land fill in Sparta, with a caretaker in charge of the dumping grounds at all times. Two Rivers states it is "hauled to the city dump and covered with sand." In Wisconsin Rapids., it is "disposed of in a former sand pit and covered with sand."

Dual Disposal of Garbage and Sewage for Port Huron

Port Huron, Michigan, will abandon garbage disposel by hog feeding, and will construct a sewage treatment plant in which it will grind garbage for digestion with sewage solids in the digestion tanks.

Trailer-type closed refuse collector

Public Works Digests

Water Supply • Sewerage • Highways and Airports

In this section are digested and briefed the important articles appearing in the periodicals that reached this office during the previous month. Appended are Bibliographies of the principal articles, in which the articles in each periodical are numbered consecutively throughout the year, beginning with our January issue.

The letter and number at the end of each digest refer to those used in the Bibliography. Numbers not found in the current Bibliography will be found in the one published the previous month.

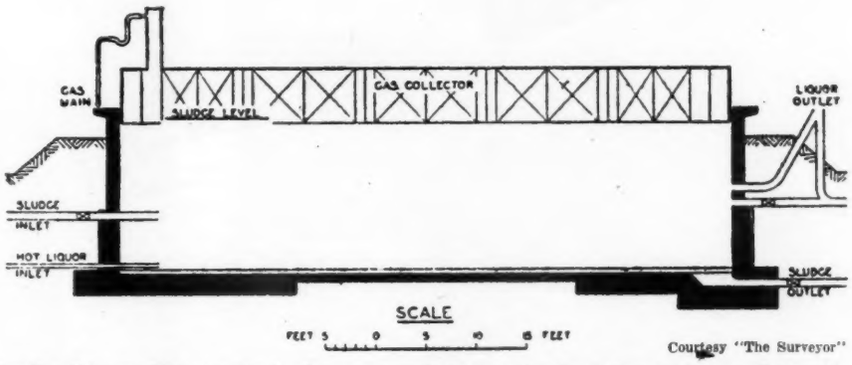
The Sewerage Digest

Sludge Treatment At Yardley, England

The Yardley works of the Birmingham Tame and Rea District Drainage Board receive sewage from 146,000 people together with about 25% factory waste, mostly iron-pickling liquor. To remove the soluble iron, 100 lb. of quicklime is added to the sewage hourly. The sewage passes through sedimentation tanks, an activated sludge plant and percolating filters. The surplus activated sludge and the solids from the filters are returned to the inlets to the sedimentation tanks. The sludge from the sedimentation tank is digested in two stages. All the gas is collected and used for heating the tanks and generating electricity for operating the plant, this being the only source of power available. The primary digestion tanks are heated by pumping, into the bottom of a tank, liquor from a secondary tank that has been settled or filtered and heated by pumping it through 2" steel tubes of a heat exchanger; the water surrounding the tubes being city water heated to 180° F. by burning sludge gas. Of all the gas collected, 46.7% is used for generating electricity, 42.7% for heating the digestion tanks, and rest burned as waste.

The sludge is dried on open beds made with 18" of ashes, being pumped to a depth of 18", which dries to an average of 6" in an average of about 6 months.

Hoppers of sedimentation tanks are emptied three times a week into a sump; sludge of suitable density is pumped to the digestion tanks, that which is too thin is returned to the digestion tanks. Each sludge tank receives, every 4 or 5 days, a charge of sludge equivalent to 17% of the capacity of the tank, of which 11% takes the place of dense sludge drawn from the bottom of the tank and 6% displaces liquor that flows through the overflow. These are averages; in each case sufficient liquor is left in the tank for heating purposes, and if liquor leaving the tank shows sign of thickening, no more sludge is introduced.[D20]



Courtesy "The Surveyor"

Yardley Primary Digestion Tank. There are no heating coils. The liquor is drawn off at mid-depth by a 9-in. pipe, forming a swan-necked overflow with a weir, exposing the liquor to view, the level of the weir corresponding to the working level in the tank. This serves as a safeguard against overfilling and enables the operator to inspect the liquor during heating and displacing.

Sludge Disposal In South Africa

Speaking before the Institute of Sewage Purification in England, in discussion of a paper on disposal of sewage sludge, E. J. Hamlin, city engineer of Johannesburg, South Africa, said that in South Africa, generally speaking, there was no discharge of sewage into rivers except in periods of flood. The whole of the effluent had to be used on the land, and no trouble whatever had been experienced in disposing of the sludge. The great difficulty was to stop people stealing it!

He believed that too much stress was laid on the chemical analysis of the sewage sludge and the availability of certain chemicals, and that there was a tendency to overlook the very important agricultural fact that the application of sewage sludge improved the tilth of the soil tremendously and in that way increased the crop production to a very great extent. On one farm he had 600 acres of Italian rye grass and 200 acres left fallow, and re-planting was done every third year. From those 800 acres the net income to the municipality was just over £11,000 per annum. On another farm he grew sufficient materials to feed 14,000 natives and to keep nearly 2,000 animals on the streets. About 40,000 bags of mealies, or Indian corn, and 28,000 bags of oats were produced, and lucerne was grown on about 400 acres. It could therefore be said that, especially in hot countries, the application of sewage sludge to the land was of inestimable value; in fact, it was of greater value than was shown by the chemical composition given by analysis.[D24]

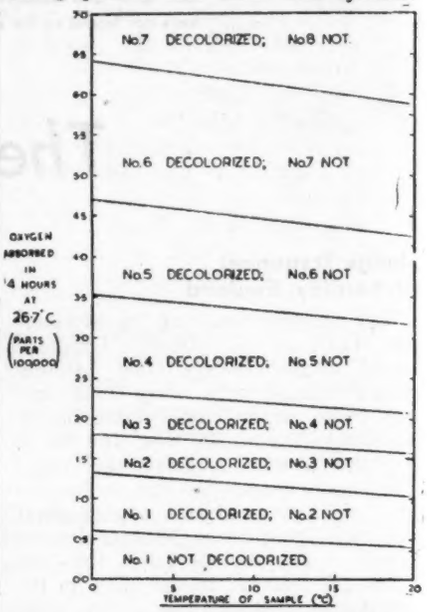
Approximate Test Of Sewage Treatment

There were many treatment plants in military camps in Great Britain at which there were no laboratory facilities for determining the efficiency of

the operation of the plant. The Water Pollution Research Laboratory developed a test intended to give a rough indication of the quality of an effluent, to be made regularly by the sewage works attendant. If tests indicated that an effluent was consistently of poor quality, a more detailed examination of samples would be made at a central laboratory. The basis of the test is the reaction of a sewage effluent with acidified potassium permanganate, there being reasonably good correlation between the proportion of oxygen absorbed and the general quality of the effluents from treatment of domestic sewage. In applying the test, equal volumes of effluent, a fixed quantity of acid, and different amounts of a solution of postassium permanganate are mixed and then allowed to stand in a series of Nessler cylinders for 30 min., after which the numbers of the cylinders in which the liquid has been decolorized are noted. As it is impracticable to make all these field tests at a specified temperature, the effect of temperature on the result was ascertained and a table and diagram prepared for reducing any result to an equivalent result at 26.7° C. The liquid is considered to be decolorized when it has a very pale brown or yellow color unmixed with pink.

No. of last cylinder in which liquid was colorless at end of 30 minutes	*Estimated range of oxygen absorbed in 4 hr. at 26.7°C; ppm*	*Character of Effluent*
Blank	0-12.5	Very good
1	10.5-23.0	Good to satisfactory
2	20.5-34.5	Unsatisfactory
3	Greater than 31.5	Very unsatisfactory

In the tests at the camps, four cylinders were used, 50 ml. of the effluent being poured into each. One cylinder was used as a blank; the other three were acidified by adding 2 ml. of the 25% sulphuric acid, followed by the addition of 2, 4 and 6 ml. to cylinders 1, 2 and 3, respectively, of N/80 permanganate solution. After standing 30 min. the color in each cylinder is noted. The range of values in the test for oxygen absorbed in 4 hrs, which correspond with the results given by the field test are shown above.[D22]


No.7 DECOLORIZED; No.8 NOT
No.6 DECOLORIZED; No.7 NOT
No.5 DECOLORIZED; No.6 NOT
No.4 DECOLORIZED; No.5 NOT
No.3 DECOLORIZED; No.4 NOT
No.2 DECOLORIZED; No.3 NOT
No.1 DECOLORIZED; No.2 NOT
No.1 NOT DECOLORIZED
OXYGEN ABSORBED IN 4 HOURS AT 26·7°C (PARTS PER 100000)
TEMPERATURE OF SAMPLE (°C)

Courtesy "The Surveyor"

Relation between results of field test and determinations of oxygen absorbed from N/50 acid permanganate in 4 hours at 267° C.

Alternating Double Filtration

In the Sewerage Digest for February was an item with the above heading dealing with a 4-year experiment with alternating double filtration at Birmingham, England. This paper was discussed at considerable length, bringing out additional facts and opinions of the author as well as of several others. While the experiment apparently proved that Birmingham sewage *could* be treated by this method at a rate 4 times as great as by single filtration, this was a limit rather than a rate recommended for general prac-

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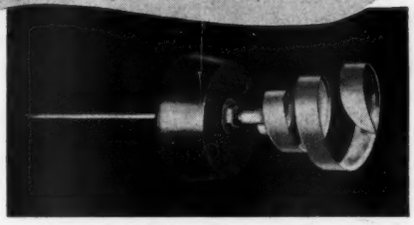

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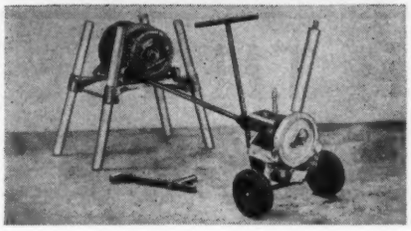

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When you need special information—consult the classified READER'S SERVICE DEPT., *pages 63-65*

tice, and a factor of safety of perhaps 2 should be used. Again, Birmingham sewage caused an unusual amount of fungus growth in the filters; in plants where this was not the case, the superiority of this alternating filtration might not be so great if at all. It had been noticed that Filter C which contained coarser stone than D, did not turn out a good effluent when operating as a primary but remained remarkably clean, while D turned out a good primary effluent but became much dirtier. [D19]

Drying Sludge For Fertilizer Base

Chicago's Southwest Sewage Treatment Works were constructed with the idea of burning the sludge, because its value as fuel was thought to be greater than that as fertilizer. However, market values changed and fertilizer manufacturers offered to purchase dried activated sludge for use as a fertilizer base at a price that made this desirable. But this necessitated changes in the equipment for collecting, processing and loading the material for shipment. Dust became a problem, and in some cases the sludge began burning in the cars before it reached its destination. Practically every known means of screening, cooling and conveying was tested before the present methods were decided upon. One of the most important changes was in the physical properties of the sludge leaving the drying system. The plant had been designed for pulverizing the sludge, but in this condition it caused dust and fire hazards and was unsatisfactory as a fertilizer base. Therefore the drying system was altered to produce a granular product, of which 95% stays on a 100-mesh sieve.

The activated sludge leaves the dryer at 190°-200° F, which is too high for safe loading into cars, and it is cooled to about 85° and the moisture content reduced to 5 or 6%. It then drops onto vibrating screens, where oversize particles, feathers and other trash are removed; the screens, of 6-mesh wire cloth, being vibrated horizontally only, since verticle components of the motion would permit feathers and splinters to pass through the screen. The screened sludge is spouted onto a belt conveyor, which discharges it directly into cars or storage bins. The Sanitary District has leased about 100 cars for transporting this product and lined them with plywood, and provided 4 hatches in the roof of each car for spouting in the sludge. As the dried sludge is very dusty and quite abrasive to bearings and other machine parts, it is confined completely to the equipment that handles and processes it by keeping every part of this under negative pressure, connecting each part by duct to the suction side of air washer fans.[H28]

Specifications For Sewage Pumps

In preparing specifications for sewage pumps, high effiiciency is not nearly so important as freedom from clogging —possibly specifying the number of cloggings during the first year that require opening the pump. Single-suction pumps are preferable for comparatively small capacities. Plain wearing rings set in finished recesses in the casings are preferred, using clean flushing water. Impellers, preferably of bronze, should be machined smooth on the outside. Shaft sleeves should be of bronze or stainless steel, with a cast iron stationary sleeve to keep stringy material from wrapping around the shaft. Bearing shells should be ground to fit bearing brackets. Handhole access ports are rarely large enough or placed in the best locations. Starting screws should be provided to break the casing from its seat. Seats of bolt heads, nuts and washers should be machined.[C19]

Tunneling a Mile of Sewer

The Baltimore, Md., sewer department has built 5,300 ft. of sewer whose invert is 33 to 55 ft. below ground level and 10 to 16 ft. below tide level in a nearby stream. Most of it was in impervious sandy clay but at many points the soil was a water-bearing sandy silt. The sewer is 27" vitrified pipe encased

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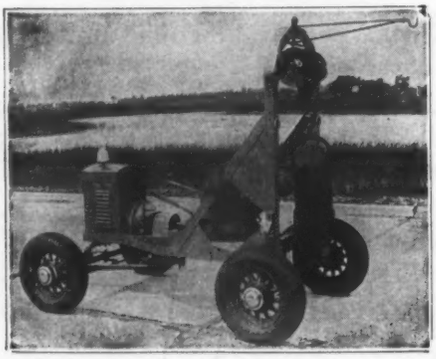

Sewers clogged with sand, roots and other debris are a constant danger to public health and safety. New installations rapidly lose their efficiency due to sand seep age.

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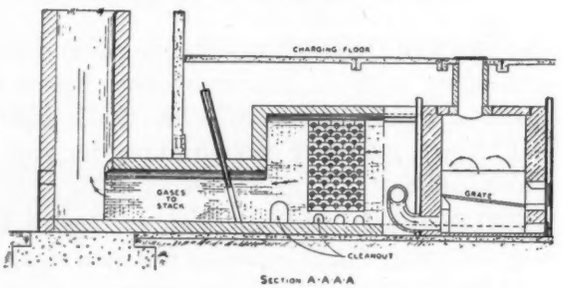

SECTION A-A-A-A

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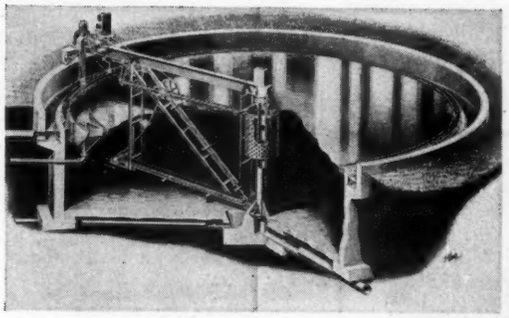
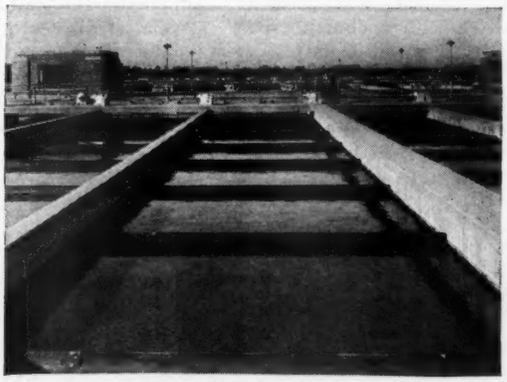
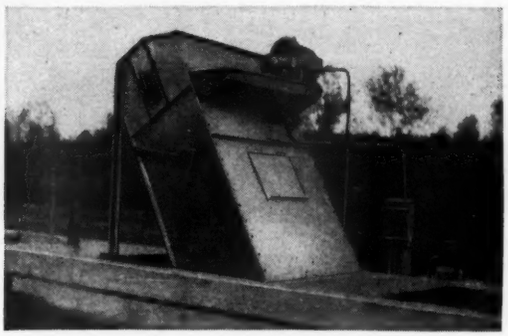


Circuline Sludge Collectors for the positive removal of sludge from rectangular tanks. Send for Book 1742.

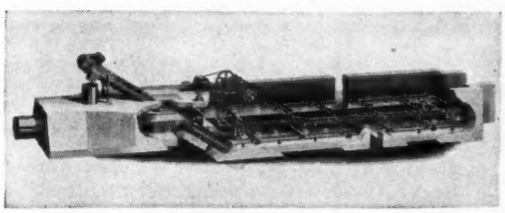


Straightline Sludge Collectors for the positive removal of sludge from rectangular tanks. Send for Book 1742.

Mechanically-cleaned Bar Screens for removing the larger floating solids. Send for Book 1587.



Tritor Screen. A combination screen and grit chamber for medium and small size plants. Folder 1587.



Straightline Grit Collector and Washer. Effectively collects, washes and removes settled grit and separates it from putrescible organic matter. Send for Folder 1942.

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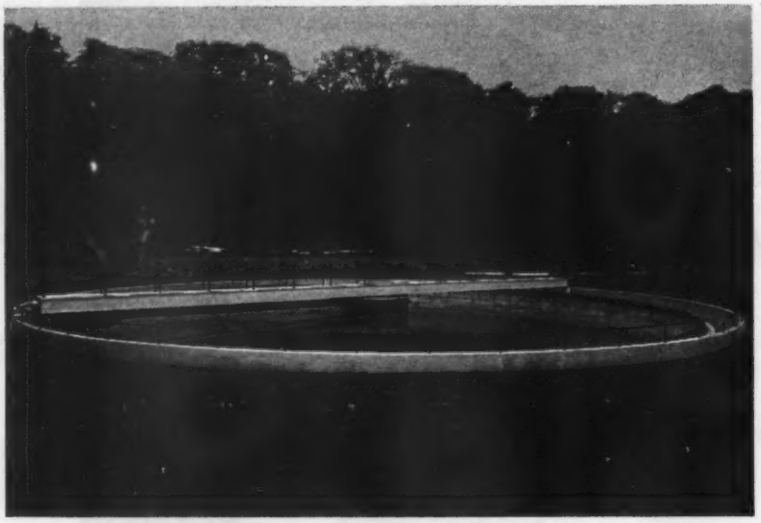
in concrete for 2,100 ft., and 30" to 36" cast-in-place concrete for 3,200 ft. The contractor decided to build it in tunnel rather than open cut, using shafts 600 ft. apart; these later being used for constructing manholes, which are spaced 300 ft. apart along the sewer. Most of the shafts were circular and lined with metal plate tunnel liners 16" wide, successive rings being added at the bottom as the excavation deepened. Some shafts were 10 ft. diameter, other 15 ft.; while a few were 10 x 10 ft. or 12 x 17 ft. and lined with timber.

The tunnel was made 5 ft. diameter. It was excavated with pneumatic spaders and the dirt removed in boxes carried on cars that were shuttled back and forth by hand on an 18" gauge track. A gravel-packed 6" drain was constructed in the bottom. Lining of 2" timber or metal plates was placed as the tunnel advanced. In some places heavy flow of water was encountered and compressed air was used at 9 or 10 psi, supplied by a 750 cfm low-pressure compressor, and conventional type locks used.

The vitrified pipe was placed in the tunnel on 6" x 8" timbers and completely encased in concrete, which was poured from the surface above through vertical 6" steel pipes installed at 50 ft. intervals along the center line of the sewer; the pipes having been placed ahead of the tunnel excavation to aid ventilation. The concrete had 8.87 gal. of water and 1½ lb. of a cement-dispersing admixture to each bag of cement, and flowed readily around and along the sewer. The same method was used for pouring cement for the cast-in-place sewer.[E5]



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Bibliography of Sewerage Literature

D *The Surveyor*

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19. Alternating Double Filtration of Sewage. Discussion of D6. Pp. 261-265.

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20. Practical Aspects of Sludge Treatment at the Yardley Works. By Norman Salt. Pp. 281-285.

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21. Toxicity to Fish of Chlorinated Sewage Effluents. P. 298.
22. Field Test for Assessing Approximately the Quality of Effluents from Treatment of Domestic Sewage. By E. E. Jones and T. H. Summers. Pp. 299-301.
23. Disposal of Sewage Sludge. By Ronald Hicks. Pp. 303-306.

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24. Sewage Sludge Composts. Discussion of D4. Pp. 321-324.
25. Effect of Mining Subsidence on Sewers and Sewage Works. P. 325.

E *Engineering News-Record*

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5. Building a One-Mile Sewer by Tunnelling. Pp. 78-81.
6. Large-Scale Sewage Chlorination at Hyperion, Calif. P. 92.

H *Sewage Works Engineering*

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28. Processing Dried Sludge in Fertilizer Production. By H. M. Snapp, Jr. Pp. 254-255, 278.
29. Sewage-Garbage To Be Digested in Proposed Plant at Norwich, N. Y. By Henry W. Taylor. Pp. 260-261.
30. The Factors Affecting Industrial Waste Treatment. Pp. 264-266.

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10. Chilton Is the First Wisconsin City to Utilize Bio-Activation. Pp. 123-124.
11. Seasonal Sewage Treatment at Lake Geneva, Wis. P. 130.
12. Study of the Sanitary Fill at Fort Worth, Tex. By R. R. Lacy. Pp. 161, 163.

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2. Ohio River Valley Water Sanitation Compact. By F. H. Waring. Pp. 195-196.

P *Public Works*

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26. Control of Housefly Breeding in Partly Digested Sewage Sludge. By Theodore A. Olson and Reynolds G. Dahms. Pp. 24, 39.
27. A City Engineer Reports on Garbage and Refuse Collection and Disposal. By T. H. Sauter. Pp. 28-30.
28. A Sanitary Engineer's Part in the War. By A. John Horn. Pp. 34-37.

S *Construction Methods*

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1. Caging a Creek with Traveling Forms. Pp. 92-93, 156.

X *Municipal Engineering*

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2. Sludge Treatment at Yardley Works. By Norman Salt. Pp. 240-242.

Y *Contractors Record*

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4. Utilizing Water Gases From Sewage Disposal Plants. By A. G. Arend. Pp. 841-842.

April 10

5. Practical Aspects of Sludge Treatment. By Norman Salt. Pp. 906-912.

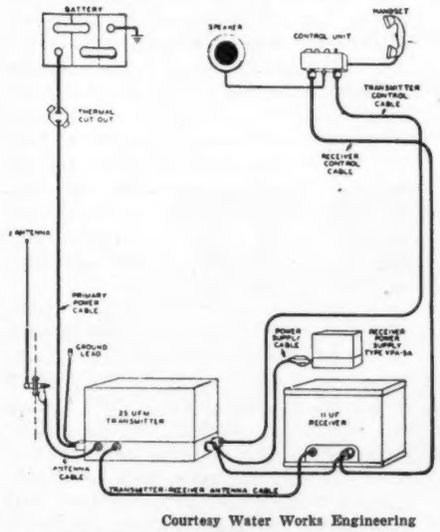
The Waterworks Digest

Radio for Water Works

A radio communication system will permit constant communication between plant headquarters and sub-stations, reservoirs, treatment units, construction and repair crews; will tie in the water supply service with other municipal services such as fire and police in normal business and times of emergency; will minimize the extent and severity of emergency and disaster; will further prompt restoration of service to the public following interruptions; will secure verbal reports from the field and send instructions to the field on situations that should be attended to immediately; will reduce miles of travel by water works vehicles, with resultant savings on fuel and oil, and will save time in reporting accidents and breakdowns. Radio equipment for mobile units costs less than 10% of the cost of the vehicle and should last for 10 years with normal obsolescence.

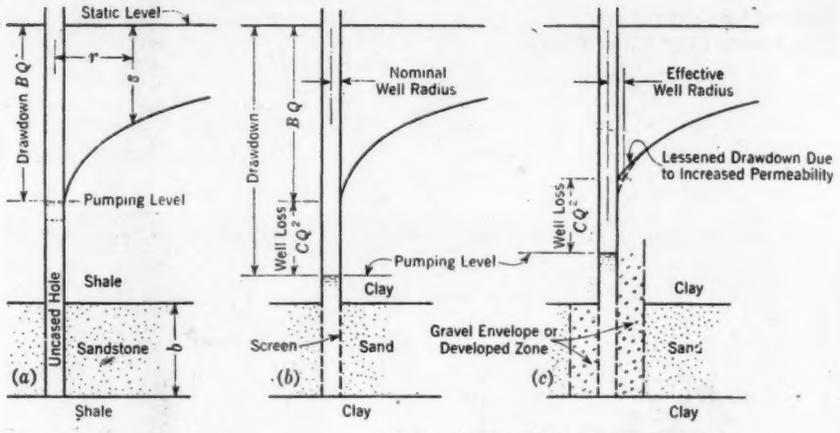
Waterworks officials seem to take little interest in the matter, and prolonged failure of the industry to use the radio facilities which have been made available by the FCC may result in a redistribution of these radio channels, to the detriment of the industry. On April 10, 1946, there ware 6 channels in the 156-162 Mc band available, 7 in the 42-44 Mc band to be ready shortly, and 12 in the 25-30 Mc band not ready for possibly 2 years.

To determine what is the best type of radio facility for a given city, consult the heads of its police and fire departments, a local member of the American Radio Relay League, or manufacturers of radio apparatus and equipment, or the Federal Communications Commission at Washington, D. C. F41



Courtesy Water Works Engineering

Components of a mobile two-way radio installation.



Courtesy American Society of Civil Engineers

Typical examples of artesian wells, showing distribution of drawdown.

Benefits from Storage Reservoirs

To meet increased war demand on its supply, Fort Worth, Tex. in 1944 built two storage reservoirs, one on the north side of the city and the other on the south side, of 4.5 mg and 5.0 mg capacity. The result was increasing supply and main pressure without increasing pump pressure, because of more hours of pumping and night storage provided. On the maximum day in 1944, before the reservoirs were in use, the maximum rate of pumping was 52.7 mgd. On the maximum day of 1945 the maximum rate was 40.0 mgd. The average pressure at the pumps on the former date was 105 psi and on the latter date 95 psi.A56

Drawdown of Artesian Wells

The discharge of an artesian well is almost but not quite proportional to the drawdown. Usually the major part of the drawdown is due to the frictional resistance of the sand against the slowly moving water and is directly proportional to that rate of motion. A smaller loss of head occurs as the water moves through the screen and casing, and is approximately proportional to the square of the velocity. The drawdown therefore can be represented approximately by the expression $BQ+CQ^2$, Q being the quantity of water being pumped; and the author develops a method for determining the value of B and C, by controlling the discharge, beginning at a fraction of the capacity of the pump and increasing the rate of pumping by steps. During each period, frequent readings of the drawdown are taken by air line or a steel tape. Also frequent drawdown readings are taken in one or more observation wells tapping the same sand. The data obtained are then plotted in four different combinations and from them the value of C is determined graphically, and the well loss for each period of the test is computed from CQ^2. Also it is possible to compute the effective radius of the well. If the storage coefficient and transmissibility of the bed and the effective radius of the well are determined, it is possible to compute the resistance B at any time.K3

Field Crews for Installing Services

St. Paul, Minn., maintains four field crews for installing service connections, two for those up to and including 2" and two for 3" and larger; the latter also being employed on emergency work. Each of the crews for the smaller connections consists of a foreman, a skilled worker (who does the tapping) and 5 to 20 laborers. Each truck is equipped with a tapping machine, long extension shovels for tunneling, gate rods, picks and shovels, barricades, etc. The crew installs copper pipe from main to property line, including a stop cock (usually 7 ft. from the property line). Plumbers lay the pipe from property line to house, connecting to the city-laid pipe if it is already in place, using a wiped joint. If the plumber lays his

pipe first, the water department makes the connection, using a mechanical joint. Connections at the main 3" and larger are made with Smith patent sleeve and accompanying gate, and cast iron pipe. Meters for residences are set inside the buildings; for large consumers and industries they are set either inside, or in concrete boxes outside. Meters are owned by the water department.[A63]

Automatic Control at Oklahoma City Filter Plant

In a 15 mgd filtration plant under construction for Oklahoma City, prechlorination of the raw water is performed at a point 1,000 ft. from the outlet end of the raw water line by remote control from the chemical building; the automatic control, solution feed chlorinator having two ranges of capacity, one from 350 to 2,000 lb. per day, the other from 75 to 450 lb., the rate being adjusted by the operator at the plant. Postchlorination will be provided by a manually controlled solution feed chlorinator. A recarbonator of the submerged combustion type is of the fully automatic pH control type, activated by the pH instrument on the filter influent.

Low lift pumps supply water to the filter plant from a reservoir 100 ft. deep. Water from the top 10 ft. of this will flow to the filter plant by gravity, but the pumps may have to operate against a head of 40 ft. To meet this condition, a 10 mgd centrifugal pump is powered by a 40 hp single-speed motor for low head, and a two-speed motor capable of either 70 or 100 hp for high head; and a 5 mgd centrifugal is similarly powered with a 15 hp single-speed motor and 32-50 hp two speed. The motors are connected to the pumps by flexible couplings.[E6]

Water Works Housekeeping

To keep water works structures in good condition and avoid or postpone the necessity of repairing them: 1—We should determine the useful life of each unit. 2—We should establish a procedure for testing and checking. 3—We should schedule each item for regular check. 4—We should catalogue each item as to type of maintenance or repair. 5—We should establish methods of procedure. 6—We should know what to do in case of failure or accident. 7—We should train our maintenance and repair personnel.[F34]

Three Types of Filters at Toronto

Toronto, Ontario, operates filter plants of three different types—slow sand filters built in 1911, capacity 36 mgd; drifting sand filters built in 1918, capacity 60 mgd; rapid sand filters built in 1941 of 100 mgd capacity. The bacterial efficiency of the slow sand filters is very high and can be maintained at less cost than by mechanical filters, although equal efficiency can be obtained with the latter if sufficient coagulant is used. Heavily polluted water containing taste-forming substances is more efficiently treated with the slow sand filter. Change to the drifting sand system was made because, during the winter, large quantities of very fine sand were brought onto the beds with the lake water, clogging them. However, this trouble was even greater with the drifting sand filters, for which reason the latest addition was made with rapid sand filters. The drifting sand plant is the only one the author has seen that could operate continuously at a high rate of filtration with water of a normal quality without any undue rise of head; they are not affected by algae and have operated over 21 days without a backwash, but require more careful operation and higher maintenance costs than standard rapid sand filters.

There are three alternative intakes in Lake Ontario, and the water at each is tested frequently and that intake used where the water is purest; which procedure has saved about $500 a week for chemicals during the past four years. At the slow sand and drifting sand plants, distillation tests invariably gave warning of the probability of taste if chlorine should be applied; but at the newest plant, intensive taste and odor occurred without any laboratory warn-

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ing, and a new technique was developed. This involves chlorination of a sample of water, immediately after filtration, with a taste-forming dose—usually about 0.5 ppm. After 30 min. contact the sample is heated to 65° F., dechlorinated with thiosulfate and tasted. If any taste is present, superchlorination treatment is commenced.[F33]

Comparison of Metering Devices

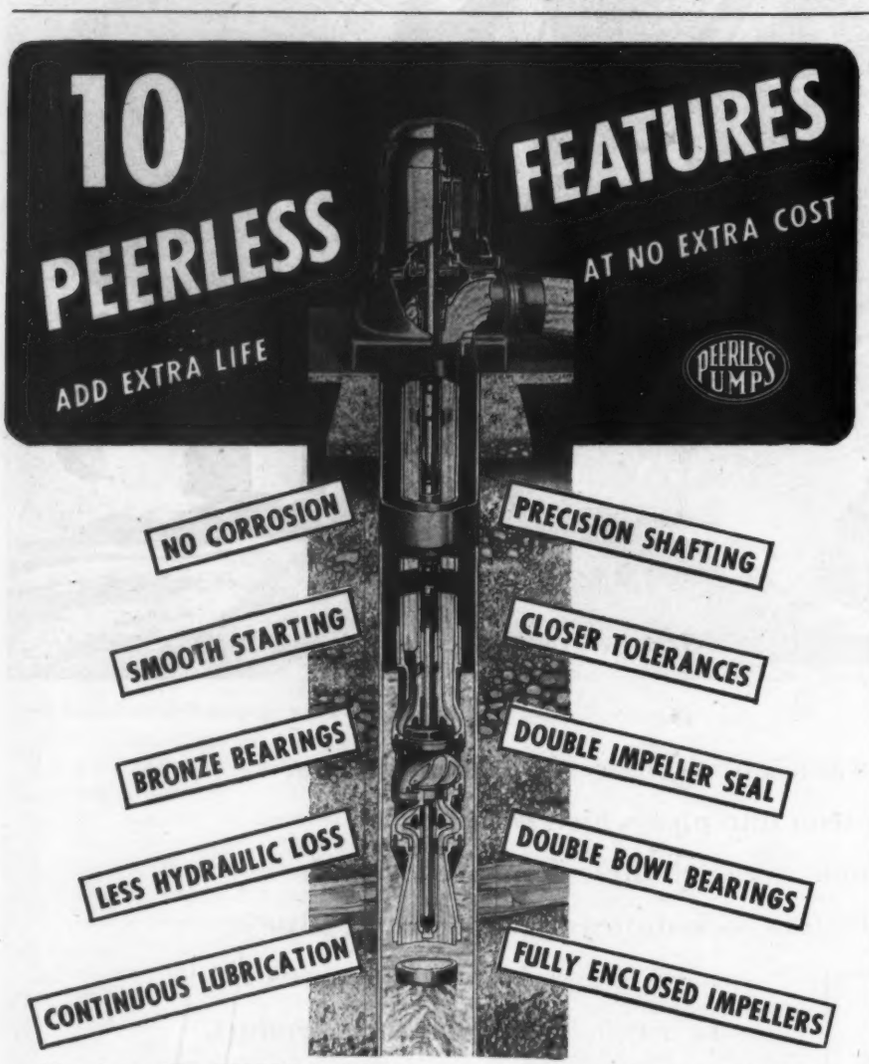
Comparing Venturi tube and orifice meters, the author says that the former cost more than the latter for purchase and installation but cause less pressure loss and therefore less cost for power. Pressure ranges as low as 2½" are available with Venturis, but a 20" range may be obtained from almost any meter manufacturer. As an illustration, taking a flow of 500 gpm through an 8" meter, the head saved by a Venturi compared with an orifice would be about 5"; pumping 12 hr. a day with power at 1.5¢ per kwh, the saving would be about $3.00 a year, at which rate it would require 81 yrs. to pay the additional cost of the Venturi. Or, taking a flow of 2,000 gpm through a 16" pipe, the saving in head by Venturi would be 4.3" at normal flow and the power saving in a year at 20 hr. a day would be $21.13, which would pay for the additional cost in 27 yr. No recognized authority has stated that either exceeds the other in accuracy in measuring clean water. The Venturi will measure more than 50% higher velocity than the orifice at the same differential, and will measure sewage more accurately. An advantage of the orifice plate is that it can be replaced easily to fit altered flow conditions and can be made by any first class machinist.

The flow nozzle can handle the same high velocities at the Venturi tube; its cost is between the orifice and the Venturi; it is somewhat less accurate than the orifice, and when the throat is computed to give the same differential, the pressure loss is about the same but the pressure recovery considerably higher. The pitot tube is mainly useful for surveys, spot checks, and rough measurements.[B6]

Water Supplies For Military Projects

In supplying water for camps in the Los Angeles district during 1941-44, 190 projects were completed, 125 obtaining the main supply from existing sources, 55 from newly developed deep wells and 10 from surface waters. The newly developed sources supplied over 75 mgd. Modern purification plants were provided in many cases, including removal of iron if this exceeded 3 ppm, and softening where the hardness exceeded 400 ppm; with individual industrial type softeners for laundries if the hardness exceeded 43 ppm. All waters were chlorinated to maintain at least 0.4 ppm residual. Portable purification and sterilizing apparatus were used in the field or in combat zones. Distillation units for brackish water came into wide use. The per capita daily allowance of water ranged from 50 gal. in a field camp to 150 gal. at a permanent post or hospital, with 70 gal. for theatre of operation or temporary type construction. Provision was made to supply the daily demand in 16 operating hours. Most of the new supplies were obtained from drilled wells equipped with deep-well turbine pumps.

One project which involved practically all of the usual methods of investigation, including geology, hydrology, aerial photography, reconnaissance, geophysics and exploratory drilling was at Kingman, Ariz. An airplane reconnaissance covering a radius of 40 miles indicated a probable source 25 miles from the airfield. Rainfall records for only 4 yr. were available, but a local rancher said the stream flow there had not fallen below 350 gpm in 25 yr., and there was considerable subsurface flow. The general geology was correlated with probes to bedrock across the basin, using electrical geophysical methods. Six-inch test wells were drilled, and later six 16" wells, using a percussion type rig. The 16" wells were equipped with deep-well turbine pumps, three of them submersible electric motor driven, current being provided by a diesel electric generator plant. In dis-



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tributing water in military projects, cross connections with non-potable supplies were not allowed under any circumstances. Pressures were maintained between 40 and 100 psi. All kinds of materials were used for pipe lines because of shortages.

For overseas, water supply was a function of engineer water supply battalions, each containing about 500 officers and men equipped with 15 water transporation units, six 750 gal. tank trucks and 9 purification trucks, 18 3,000 gal. canvas tanks and 6 260 gal. canvas basins. A purification unit is a 90 gpm, truck-mounted filter plant, using ammonia alum, sodium carbonate, and liquid chlorine. For smaller and isolated groups, a 15 gpm purification unit using hydrochlorites was provided. Portable distillation apparatus was supplied in sizes of 50 to 250 gph, consisting of single-effect and double-effect evaporation, pump, oil-fired boiler, and condenser. This was used only where other sources were entirely unavailable.[A65]

Laboratory Equipment For Small Plants

The size of laboratory and the equipment required will vary with the type of treatment used and the population served. Except in the smallest plants, a separate laboratory room should be provided, free from dust and equipped with benches, cupboards, sink with hot and cold water, and electrical and gas outlets. If possible, the laboratory should be so located that north light is available. Electric wiring should be of such size that it will carry the load required for heating units if they are to be used.

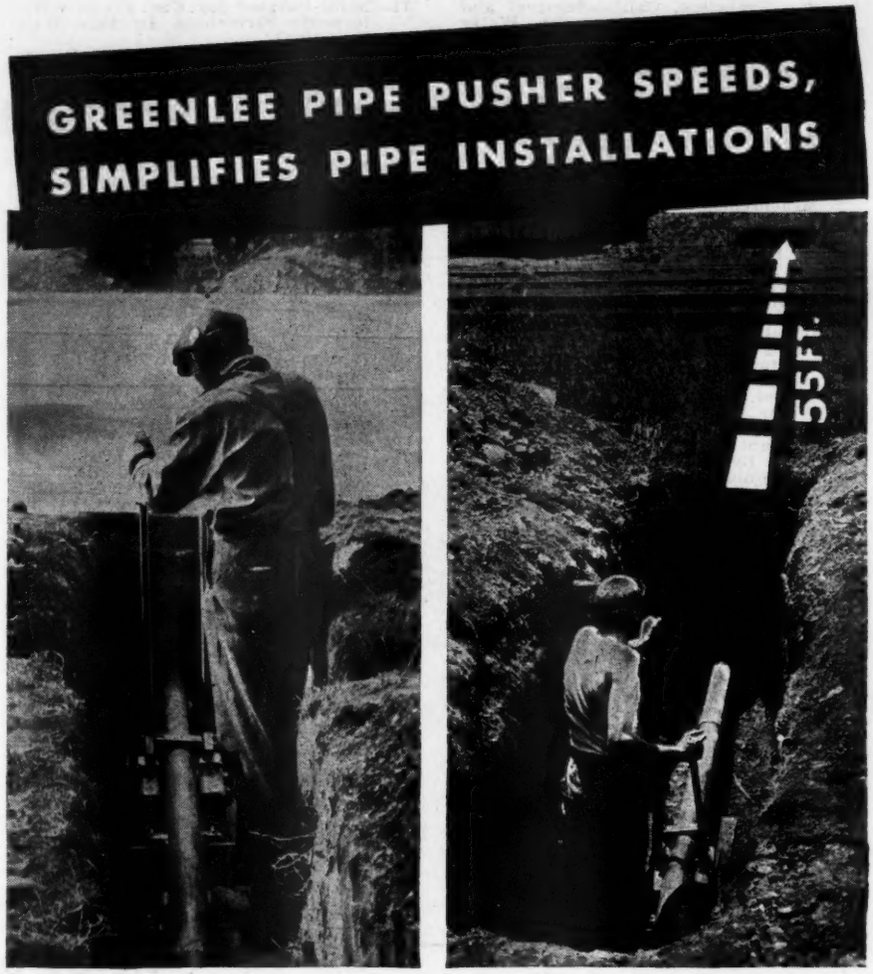
Among the procedures for which the small plant should be equipped are determinations of residual chlorine, color, odor, turbidity, pH values, alkalinity, and various bacteriologic and biologic examinations. Provision should also be made for "jar tests" whereby the plant processes may be duplicated on a laboratory scale, and the quantities of chemicals, speed of mixing and time of coagulation required to produce a satisfactory effluent may be determined.

The author lists in detail the equipment that should be provided for making each of these determinations.[F40]

Bibliography of Waterworks Literature

A *Journal, American Water Works Ass'n—May*

64. Des Moines Pension and Retirement System. Pp. 589-594.
65. Development of Water Supplies for Military Projects. By Rufus W. Putnam. Pp. 595-607.
66. Restoring Manila's Water System to Service. By Lloyd K. Clark. Pp. 608-624.
67. Okinawa — DDT and Water Treatment. By Alden E. Stilson. Pp. 625-636.
68. Sizing and Installation of Services. By George Roden. Pp. 637-642.
69. Distribution System Problems, By M. E. Driftmier, E. E. Schanze and H. H. Kansteiner. Pp. 643-646.



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70. San Francisco, Calif.—Survival and Retirement Experience with Water Works Facilities. Pp. 647-661.
71. Springfield, Mass.—Survival and Retirement Experience with Water Works Facilities. Pp. 662-685.

B *Journal, New England Water Works Ass'n—March*

5. The Financing of Water Main Pipe Extensions. By Walter C. Conroy. Pp. 1-14.
6. Choosing a Primary Device for Flow Measurement. By L. K. Spink. Pp. 15-20.
7. Experiences of a Transportation Officer in the ETO. By Richard Kimball. Pp. 21-26.
8. Internal Combustion Engines in Waterworks and Sewage Plants. By A. M. Boehm. Pp. 27-31.
9. Infectious Hepatitis. By Roy F. Feemster. Pp. 32-42.
10. Sanitation and Public Health Experiences in Europe. By Leonard W. Trager. Pp. 43-53.
11. Water Supply in the Asiatic-Pacific Theatre. By Edwin B. Cobb. Pp. 54-67.
12. Hydrant Flow and Pipe-Condition Tests. By Scott Keith. Pp. 68-82.
13. U.S. Public Health Service Drinking Water Standards. Pp. 83-98.

D *The Surveyor*

April 5

9. Scottish Water Rates and Charges. P. 271.

April 19

10. Overseas Water Supplies. P. 312.

E *Engineering News-Record*

May 2

6. Unit Construction of a Filter Plant. Pp. 97-100.
7. Tapping of a Wet Well Under Pressure. Pp. 101-103.
8. Design of First Flexible Pipe Joint Resulted From Study of a Lobster's Tail. By M. N. Baker. Pp. 104-105.
9. Unique Propeller Pump Installation Increases Flow in Gravity Water Tunnel. By Dewey M. Radcliffe. Pp. 106-108.
10. Cement Joints Minimize Leakage in Cast-Iron Water Lines. By K. F. Hoefle. Pp. 108-109.
11. Multi-Purpose Seal Coat Protects Waterworks Structures. By Paul Weir. Pp. 110-113.
12. Los Angeles Makes Its Own Zeolite. Pp. 114-115.
13. Fluted Central Column New Feature in Tank Design. By R. M. Dowe. Pp. 116-118.

F *Water Works Engineering*

April 17

29. Study of Merits of Various Confirmatory Media. By P. J. Philson. Pp. 386-388.
30. Iron and Manganese Removal. Pp. 394-395, 411.

May 1

31. Water System of St. Louis. By Thos. J. Skinker. Pp. 456-458.
32. Did Your Water Works Do a Good Wartime Job? By Leonard N. Thompson. Pp. 459-460.
33. Des Moines Infiltration System Was Developed Methodically. By Charles B. Burdick. Pp. 461-463, 534.
34. Good Waterworks Housekeeping; Maintenance or Repair—Which? By Wendell R. La Due. Pp. 464, 520.
35. Reconversion Period Shows $850,000,000 To Be Spent. Pp. 465-470.
36. Manufacturers Can Now Quote Short-Time Firm Prices Only. Pp. 471-472.
37. California's Big Softening Plant Increases Its Output. Pp. 473, 522.
38. Experiences With Three Types of Filtration Plant. By Norman J. Howard. Pp. 474-477, 522.
39. Iron and Manganese Removal. Pp. 481, 510.
40. Laboratory Equipment for Small Water Treatment Plants. By Wallace W. Sanderson. Pp. 482-484.

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41. Radio for Water Works. By Roi B. Wooley. Pp. 568-571.
42. Revised House Pollution Control Bill Is Drafted. Pp. 585-586.
43. Iron and Manganese Removal. Pp. 587-588.

J *American City*

May

7. Chicago's 320 mgd Filtration Plant Nears Completion. By W. W. DeBerard and John R. Baylis. Pp. 101-103.
8. Hastings' Water Utility Has Seen 60 Years of Service. By Andrew S. Reiff. Pp. 108-110.
9. Appleton, Wis., Gets Rid of the Algae. by Wm. U. Gallaher. Pp. 118-119, 167.

K *Proceedings, American Society of Civil Engineers—May*

3. Effective Radius of Drawdown Test to Determine Artesian Well. By C. E. Jacob. Pp. 629-646.

L *Civil Engineering*

May

8. Chicago's South District Filtration Plant Placed in Partial Operation. By W. W. DeBerard and J. R. Baylis. Pp. 197-200.

M *Water and Sewage*

April

9. Survey of Groundwater Resources. By Archibald K. Watt. Pp. 60-65, 109.
10. Water Treatment in Etobicoke, Ontario. By Franklin McArthur. Pp. 66-67, 129.
11. Water Softening in North York. By G. H. Baker. Pp. 68-69, 101.
12. Water Rate Structures in Canada. By William Storrie. Pp. 70, 122.
13. Accounting Under Commission By S. Howard Gillett. Pp. 114, 116.
14. Accounting Under City Council. By H. S. Nicklin. Pp. 118, 120.

P *Public Works*

May

20. Practices of City Water Departments in Regard to Cross Connections, Pp. 22-23.
21. Costs of Laying Water Pipe. P. 26.
22. Classification of Municipal Water Supplies in the United States as to Aggressiveness. P. 27.
23. Water-Borne Outbreak of Gastroenteritis in an Industry. P. 33.

V *Journal, Maine Water Utilities Ass'n*

May

6. Water Utility Extensions. By Frank E. Southard. Pp. 58-61.

Y *Contractors Record*

April 17

9. Safeguarding Water Supplies. By E. F. Mackenzie. Pp. 68-70.
10. Centrifugal Pump Peculiarities. By Robert W. Angus. Pp. 71-75.
11. Water Rates and Charges for Scotland. P. 78.

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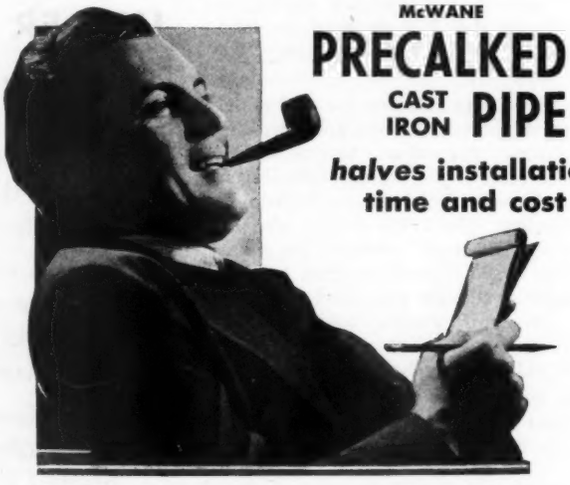

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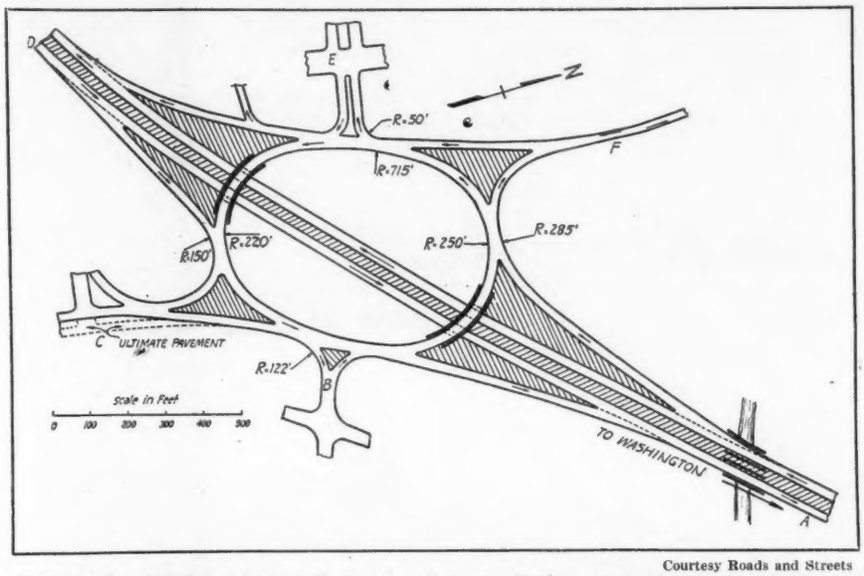
Two-Bridge Rotary Intersection

A combination of pairs of access ramps and a rotary intersection for two cross sheets was used to provide a complete interchange facility on the Shirley Memorial Highway in Arlington, Va., a controlled access highway into Washington, D. C. This highway is depressed where it crosses the intersection area, and the elliptical rotary passes over it on two bridges. Four-lane street connections are provided to a shopping center on the west (E) and to a residential development on the east (B). Connections between the rotary and the expressway are made by two pairs of one-way ramps. The expressway is designed for a speed of 70 mph and the rotary for 35, the long ramps leading down to and up from the expressway facilitating change of speed. The rotary roadway consists of two 13 ft. lanes completely around the ellipse, with a third outer lane in all weaving areas.[N35]



Courtesy Roads and Streets

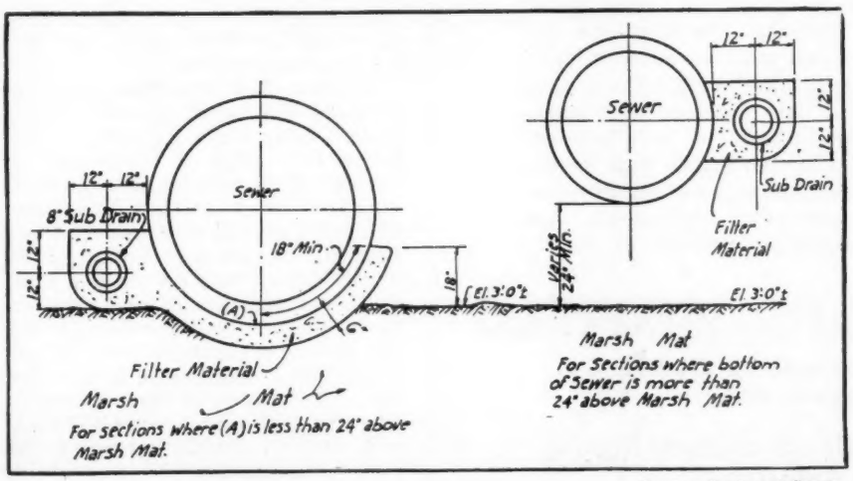
General plan showing principal dimensions of the two-bridge rotary and functional elements.

Draining Idlewild Airport

Idlewild Airport, on Long Island, N. Y., contains 4,800 acres, of which the central terminal area will include 512 acres, largely 14" concrete pavement. It is formed by 8 ft. depth of sand pumped onto meadowland whose elevation was about mean low water, which compacted under the pressure to firm, hard clay, practically impervious to downward percolation. Most of the subsidence occurred during the first six weeks, practically none after the first year. By means of sand analysis and test wells it was learned that only 10% of the annual rainfall moved laterally through the sand to the bay, the bulk being evaporated from the top 2 ft. of the sand, or running off over the surface after heavy rains.

Designs were based on immediate run-off from runway pavements, ponding of gutter overflow to be allowable in sod areas adjacent to aprons; ground water level under pavements to be kept below frost line; storm drains to be jointed with plastic material and trench backfill compacted; gutter type pavement section for runways; drainage along taxiways similar to that for runways; off-pavement area water to be removed by ponding and vertical infiltration. The grades were very flat and sewers up to 72" were required, which provided considerable sewer storage. Catch basins were placed 400 ft. apart in gutters 40 ft. from the edges of the runways and 20 ft. from the taxiways, a light pavement connecting the runway to the gutter.

Asbestos cement pipe was used for 8" and 10" pipe, concrete for the larger sizes; porous concrete for subdrains. A subsurface drainage system was installed to keep the ground water level below the frost line in all pavement areas. Surface and subsurface water are carried in the same system by the use of back-water gates which prevented water, under a head during storms, from being forced back through the porous pipe into the subgrade. The porous subdrains were surrounded with filter material, and this material was carried under adjacent large storm sewers where these rested on the impervious clay, to permit ground water to reach the subdrain from the other side of the sewer.[N32]



Courtesy Roads and Streets

Typical section of Idlewild storm sewer and subdrain.

90,000,000 Square Yards Of Airfield Paving

During the past five years U. S. Army engineers constructed in the seven southeastern states 40,000,000 sq. yd. of asphaltic concrete runways, taxiways and aprons, 20,000,000 sq. yd. of sand asphalt pavements, and 30,000,000 sq. yd. of cement concrete. They learned that two "musts" for good airport paving are compaction and adequate thickness, of which the former is the more

important. The type of pavement specified depended largely on the supporting power of the subgrade, availability of local materials, equipment available, required speed of construction and design criteria of the expected wheel loads. Flexible-type subbases of whatever material were compacted in layers to at least 95% density by the modified AASHO method.

In constructing asphaltic wearing surfaces, salient factors were use of as high a penetration asphalt as possible consistent with required stability; as rich a mix as possible; low mixing temperatures; a designed mix of reasonably high stability; surfaces of low abrasiveness; and tight sealing. In the south the ideal penetration is between 100 and 120. Best results were obtained with hot mixed, plant-produced asphaltic concrete, mixed at 225°F.[E18]

Postwar Highway Problems

There is need of investigational work on road building materials. Some of the most pressing problems described by the author are as follows: A simple, general, universally applicable classification of soils. Development of simple test procedures, with emphasis on mechanical equipment; especially desirable for secondary road construction. Development of sound policies governing stage construction; it should not become the maintenance engineer's problem. Correlation of data on the effect of distribution of loads, traffic, drainage, etc., in the evaluation of soils. Advancement in design and capability of compaction equipment is definitely needed.

In some areas high-quality granular materials are becoming scarce and new methods must be found for using materials formerly considered structurally inferior or otherwise undesirable. In some cases, concrete structures are deteriorating rapidly, probably because the aggregates and cements are not compatible. The present requirement for fine aggregate that not more than 3% shall pass the 200-mesh sieve is excluding many sands that have produced good concrete, and 5% or 6% might be a more desirable limit. Is the greater degree of fineness of cement required since 1930 a good thing? What percentages of potassium and sodium oxides are permissible in cement?

There is need for simple quality tests of asphaltic materials that are correlated with service. Of how much importance is the penetration test? Asphaltic joint and crack fillers are not satisfactory; are the new asphalt-rubber materials enough more so to warrant paying ten times as much per ton for them? Of what value are the additives offered for changing the characteristics of asphaltic materials? Stabilization, air entraining, curing, paints, and waterproof surface covering for concrete are other problems.[R26]

Limerock for Florida Roads

Florida limerock is very soft compared with most rocks used for road building. That from the neighborhood of Ocala, which is the one most used for road construction, has a general granular texture although some parts are a hard compact rock, and others are loosely coherent and pervious to water. Chemically it consists almost entirely of carbonate of lime. It is used in road construction for flexible bases which are surface-treated or covered with some type of bituminous wearing surface. The softness of the rock permits shaving off the base with a grader, obtaining a very smooth surface.

In 1944 the Florida State Road Department constructed an experimental project, using Ocala limerock, on U.S. Route 441, about 2 miles north of Gainesville. Of this project, 4,500 ft. was plain cement concrete using limerock as the aggregate and cement in proportions of 5, 6 and 7 bags per cu. yd. respectively on different sections. Dummy joints were located at 15 ft. and 20 ft. intervals. At intervals of 150 or 200 ft. ¾ in. expansion joints of preformed fiber fillers were placed, and ¾ in. dowel bars. A vibratory paving tube was used for vibrating 400 ft. of each 500 ft. length, but the results were unsatisfactory because of the highly plastic nature of the concrete.

One length of 1,000 ft. was con-

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3 to 14 tons
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6 to 12 tons
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SURFACE irregularities vanish under the 3-axle tandem. As any one roll contacts a high spot, it automatically "borrows" additional weight for greater compaction. This, together with exclusive Buffalo-Springfield *synchronized steering* of the two guide rolls makes possible smoothness of rolling not possible with any other equipment. Ask your distributor for details.

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structed as limerock-cement stabilized base using 7% of cement, a traveling plant mixer, and sheepsfoot, 3-wheel and pneumatic-tire rollers. The density was well above 95%. After 21 days it was primed with tar and lightly sanded; and two weeks later with 0.2 gal. of cutback asphalt, sanded.

Three 1,000 ft. sections of old penetration macadam on a limerock base 16 ft. wide were rebuilt by removing the macadam, scarifying the base and widening it to 22 ft., bringing it to 8" thickness by adding new limerock, then mixing the top 2" with three kinds of bitumen, each for a length of 1,000 ft.—2.27 gal. per sq. yd. of RC-1 cutback asphalt, 2.2 gal. of RT-6 tar, and 2.6 gal. of slow-breaking emulsified asphalt.

After 1½ years of use, all the sections are in very good condition except the tar section, which has developed numerous surface cracks. The concrete section has developed one surface crack.[R19]

Surface Dressing with Tar

The author, speaking before the Institution of Highway Engineers in London, said that 500,000 tons, or 100 million gallons, of road tar is produced annually in England. This is used as surface dressing, tar macadam, in bases, as carpets and wearing courses, gravel macadam, fine carpets, and dense tar surfacing.

Concerning surface dressing, he said that if a road is in good shape and merely has lost its non-skid properties, or the surface has become hungry and lacking in resistance to wear, then surface dressing is the cheapest and most satisfactory method of maintenance, however heavy the traffic. But it cannot be repeated indefinitely without loss of contour and of the riding qualities of the road. Experimental work has shown that the most important factor determining the durability of a surface dressing is the rate of application of the tars. This is more important even than the nature of the tar. As an example of this, some experiments may be referred to in which a wide variety of tars, applied at the same rate of cover, all gave equally satisfactory results, whereas in other experiments one tar, applied at different rates of spread, gave results directly related to the thickness of the tar film.

The majority of premature failings of tar dressings are the result of shortage of tar. In many cases the average quantity is adequate, but the distribution is uneven, so that certain areas are short, and from these areas the stone is dislodged by traffic. On the other hand, the quantity of tar must not be excessive, otherwise bleeding will occur.

It has been found that, in order to give consistently good results, the rate of application of the tar should not vary by more than ± 10 per cent. Such a degree of uniformity of distribution cannot be obtained by hand methods, and is only given by a well-designed mechanical sprayer. Gravel requires

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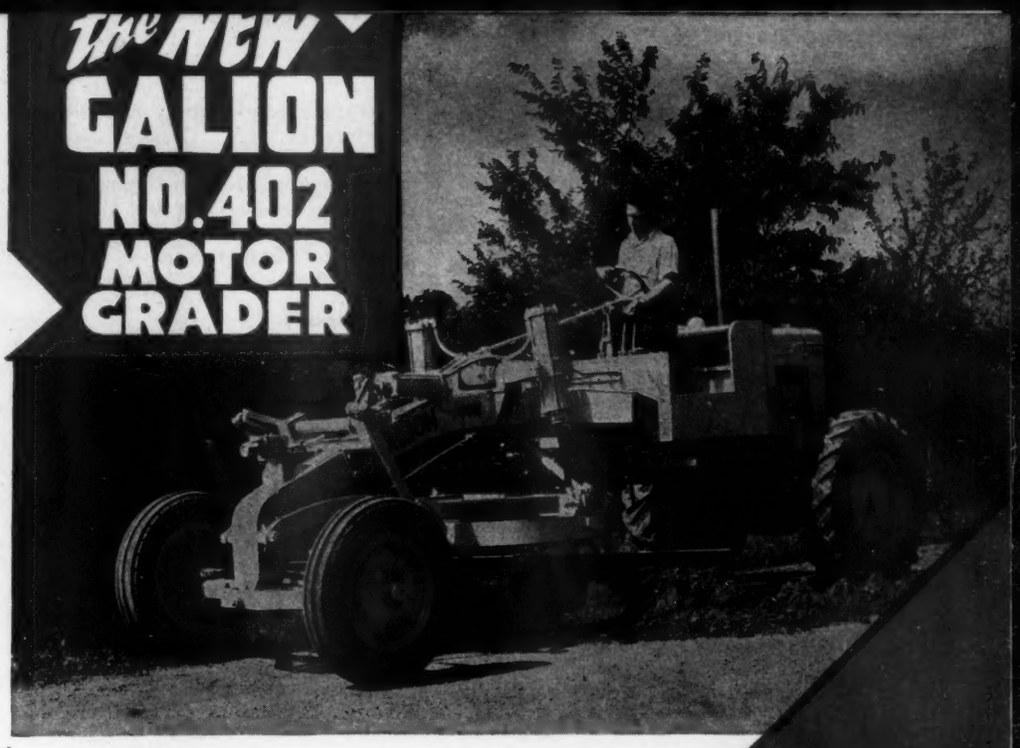

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some 20 per cent more tar than igneous rock chippings of the same size. When this additional tar is used, the life of a gravel-dressed surface compares favorably with that given by chippings.[D15]

Asphalt for Erosion Control

Asphalt concrete has been used as a mat 2" to 6" thick to protect road embankments against wave or current action. More recent is the use of a thin film of asphalt on a prepared slope after it has been seeded and saturated with water. This protects the slope against erosion from wind and rain, aids in holding the moisture in the soil until the plants have developed sufficient root growth to resist droughts, and raises the temperature of the soil slightly, thus aiding early germination of the seed. The plants push their way through the thin film of asphalt or through cracks in it formed by shrinkage. Best results are obtained with 0.2 gal. per sq. yd.; less will disintegrate too soon; more prevents emergence of grass. The asphalt film completely disintegrates in about a year. Best results are obtained by using an MC cutback of asphalt of less than 50 penetration airblown with a kerosene distillate specially treated to remove its toxicity to plant life. Hard asphalt is desired because it cracks readily, permitting the grass to come through. It is sprayed on by a hand hose and nozzle or spray bar at a temperature of 165°. Grasses that have shown good emergence in Missouri are Bermuda grass, Korean lespedesa, alfalfa, yellow sweet clover and alta fescue. The asphalt film is usually cheaper than straw mulch, is non-toxic, free from weeds and quickly and easily applied.[N36]

Continuous Maintenance

Maintenance means keeping the road or street in a smooth, comfortable, safe and economical operating condition. The most important consideration is a comfortable riding surface; roadside development is the least. Every small break should be repaired at once. A road should not be permitted to become "Slippery When Wet"; a seal coat of heavy bituminous material covered with hard, durable stone chips, or a covering of sandstone rock asphalt will prevent skidding. If at all possible, bituminous seal coating or surface treatment should be applied in the spring, for they should have a few weeks of hot weather after placing so they will compact and seal under traffic. Often a thin seal coat is all that is needed to renew the surface.

In many concrete pavements, pumping at joints is the most troublesome and expensive maintenance problem. The author's answer is to eliminate expansion joints except at bridges, culverts, pavement intersections, etc.; an occasional blow-up can be repaired more cheaply than expansion joints can be maintained.

Traffic-bound stone or gravel roads should contain no aggregate larger than ¾ in. They should be bladed or dragged throughout dry seasons as well as wet. If dragging every two or three days becomes necessary, stabilization with calcium chloride or bituminous surfacing is desirable.[N29]

Uniform Cost Accounting for Counties

By cooperation of Minnesota state and county highway officials a uniform county cost accounting system has been developed. As a basis for keying records and distribution of costs there has been established a master chart of accounts to enable work performed to be identified by branch, class and unit. Branches are identified by capital letters: A, administration; E, engineering; C, construction; etc. Each branch is subdivided into classes, identified by lower-case letters in normal sequence, such as a, routine; b, repairs; c, betterments; d, special work. Each class is divided into units or operations, designated by numerals, such as 1, smoothing surface; 2, minor surface repairs, etc. To obtain data for this accounting system, it is necessary that individual employees file daily maintenance reports, giving the road sections on which he

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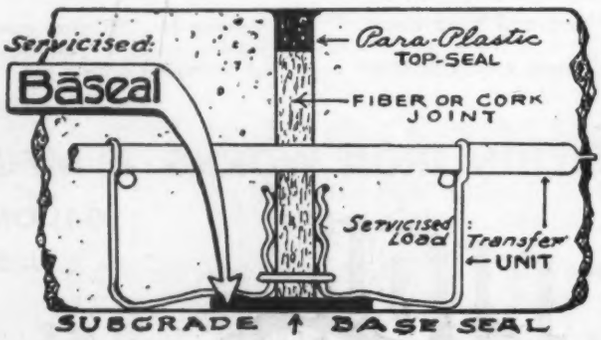

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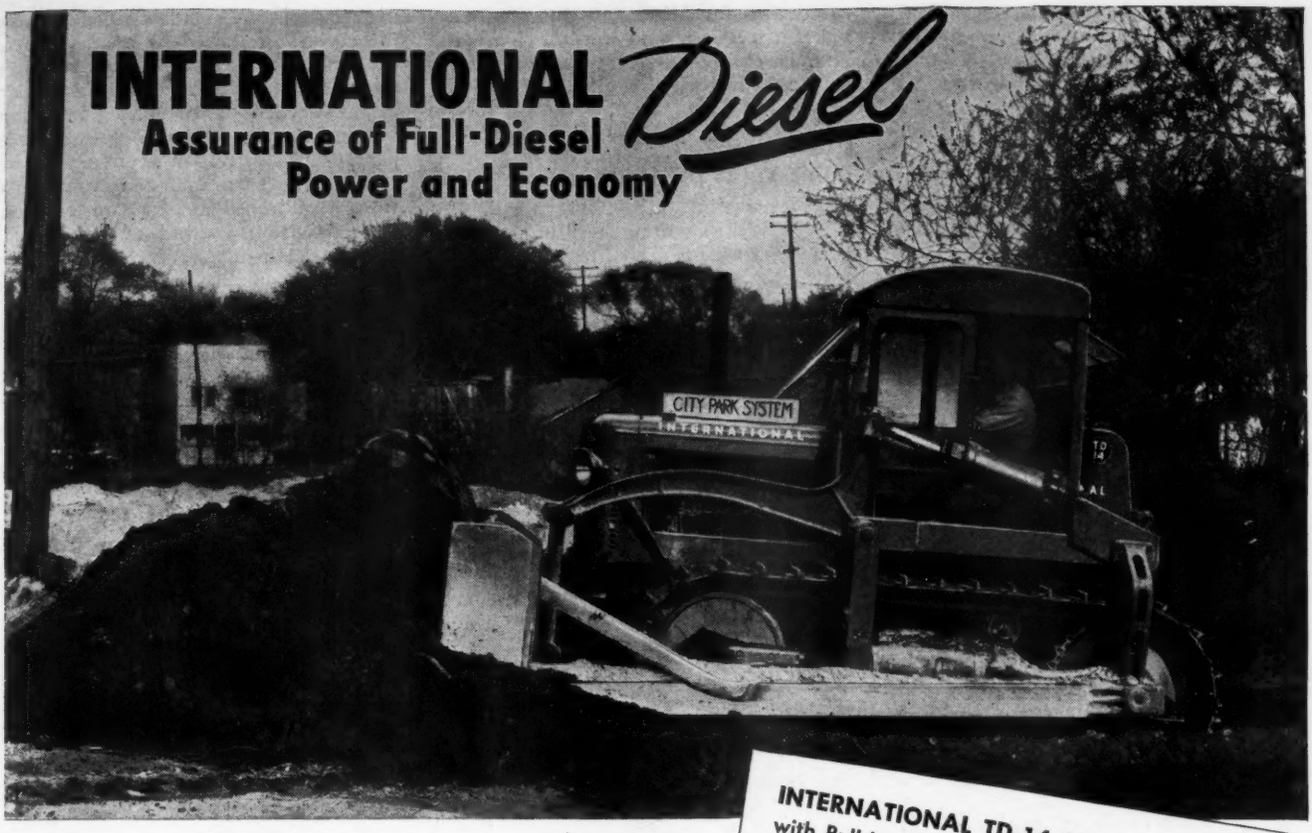

INTERNATIONAL TD-14 Diesel TracTracTor with Bulldozer moves 300,000 yards of sand and gravel to level and reclaim land for a City Park along a river. Material moved was dredged from the river. Cost for fuel averaged 1/10 of a cent per yard!

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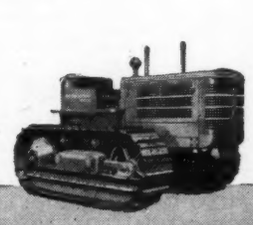
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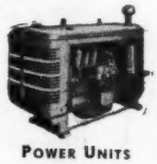
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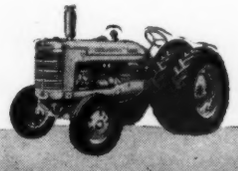
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worked, equipment used, hours worked on each section and miles covered. The employee's record card was the first standard form. The second was an equipment cost and earnings record. The third was the road or job cost record. An individual maintenance record and an individual construction record are kept for each road or road section. The road cost enables the engineer to determine at any time what operations are costing on any section of road. Other forms in the system are a perpetual inventory form and an individual vendor's record. It is anticipated that all counties will also maintain an accounts-receivable ledger. An innovation in cost accounting for Minnesota counties is a warrant register and control journal. Another proposed form provides for keeping a history of equipment cost and expense.[R16]

Excavating 700 Cubic Yards per Hour

In excavating 1,200,000 cu. yd. of sandy clay in rolling terrain in construction of the Shirley Memorial Highway into Washington, D. C., the contractor removed small to medium trees with bulldozers, piling them for burning with crawler-cranes, which also trenched for culverts and set the culvert pipe. Tractor-drawn scrapers took first leveling passes in the cuts and filled holes in the ravines; followed by a heavy-duty, tractor-drawn loader which, with an elevator belt (like an elevating grader loader) loaded six 16 yd. bottom-dump wagons, moving about 7,000 cu. yd. per 10-hr. day for an average haul of 1,000 ft. over a route on which ruts were kept ironed out by two graders. Use of a rooter ahead of the loader, though not really necessary, probably added 10% to 20% to the daily output. The cuts were kept rutless and crowned at all times so that rain did not make the going difficult for the trucks. Two bulldozers spread the dumped material and a 6-drum sheepsfoot roller compacted it to over 100% density. A great deal of compaction was accomplished by the rubber tires of the wagons and scrapers.[N34]

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Bibliography of Highway and Airport Literature

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20. Use of Mechanical Methods in Concrete Road Construction. By B. F. J. Bradbeer. P. 302.

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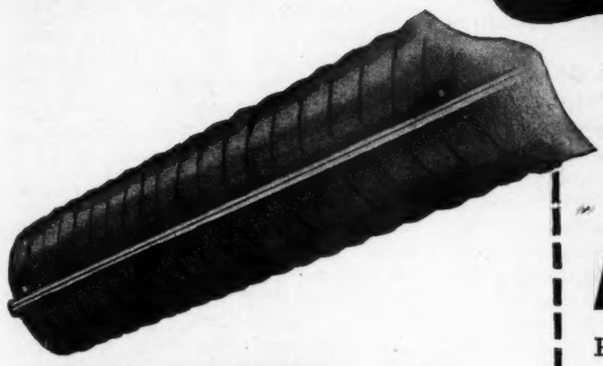

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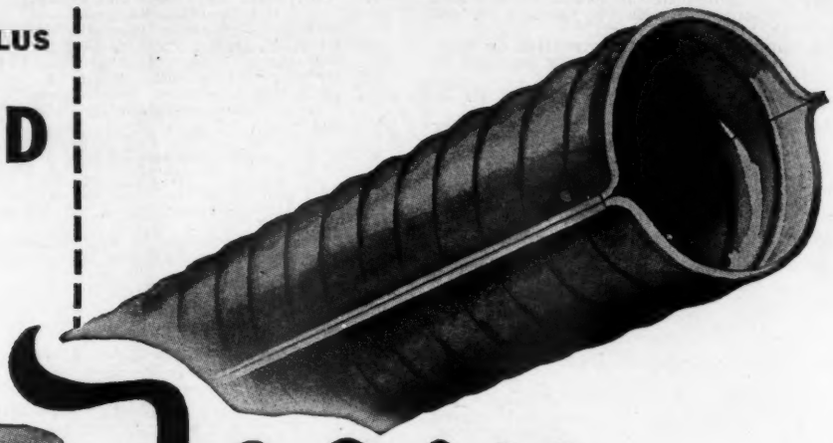

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22. Improved Road Construction by Soil-Processing Technique. By Bernard E. Gray. Pp. 82-83, 165.
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16. Some Experiments in Soil Stabilization. By C. E. Fellows. Pp. 900-902, 919.

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17. The Construction of Concrete Roads. By B. F. J. Bradbeer. Pp. 1037-1038.

Z *Highways, Bridges and Aerodromes*
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9. Road Tar Experiments in England. P. 4.

Lack of Warning of Decaying Roadside Tree Held Negligence

The New York Court of Claims (Brown v. State, 58 N. Y. S. 2d 691) holds that "the State is obligated to maintain its highways in a safe condition for travel, not only with regard to obstructions and defects in the travelled portion of the road, but also with regard to conditions adjacent to and above the highway which might reasonably be anticipated to result in injury and damage to the users thereof." Damages were awarded to the occupant of a truck and to the truck's owner for injury and damage as the result of contact with a tree which had fallen across a highway. The tree, a large elm, had either fallen a short time before the collision and was suspended a few feet above the road by wires and trees, or had fallen upon the truck as it was passing about 1.00 A.M. on a clear windless winter's night.

The court held that the State patrolmen should have noticed the decayed condition of this tree and its possible danger to users of the highway, and their failure to give due and adequate warning of this potential danger constituted negligence.

Airport Equipment.—Typical lighting plans and wiring diagrams for all classes of airports are included in a new 56-page booklet, "Airport Electrical Equipment" (B-3573), announced by Westinghouse. Designed to meet CAA and Army and Navy standards, equipment listed and described in the booklet is keyed by symbols to wiring diagrams and lighting layouts in the plan sections, to assist airport engineers in meeting specific requirements for any type of airport operation. Distribution equipment described includes fuse cutouts, relays, regulators, transformers, panel boards and control panels. The section on lighting equipment covers beacons, floodlights, boundary and obstruction lights, contact lights, ceiling projectors, wind indicators and other units. A third section of the booklet on associated airport equipment includes special equipment for small airports, alternate distribution apparatus, battery chargers, engine starters, and stand-in power plants. Copies may be secured from the Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

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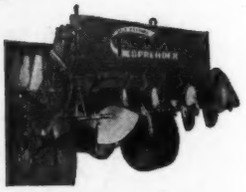

Illustration above shows new safety housing now used on Flink WD31 and HD4. Model WD31 is chain driven from rear wheel. Model HD4 has a hydraulic drive. Both controlled from cab. Illustration right: safety cover removed.

FLINK COMPANY, DEPT. 6, STREATOR, ILL.

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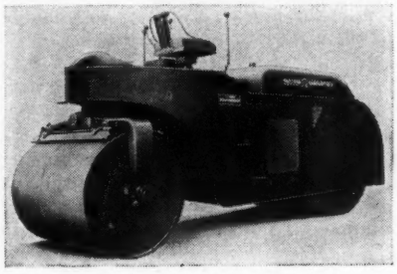
PUBLIC WORKS Equipment News

New Buffalo-Springfield Tandem Rollers

A complete new line of streamlined tandem rollers incorporating many new and superior mechanical improvements has just been announced by the Buffalo-Springfield Roller Co. of Springfield, Ohio. These models supplement the new 10 and 12-ton 3-wheel rollers and 3-4-ton tandems previously announced. The new models are 5-8 tons, 6-9 tons, 8-12 tons, and 10-14 tons and can be powered with either gasoline or Diesel engines.



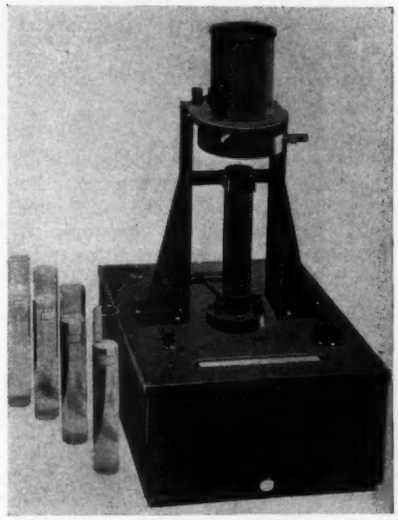
New Buffalo-Springfield streamlined tandem roller.

A new simplified 4-speed forward and reverse transmission has been added to provide a properly stepped speed range for all types of operating conditions. Increased operator vision is provided with the new models as a result of a cutaway section of the drive roll hooding, and the sprinkler tank capacity has been considerably increased. The general appearance of the rollers has been streamlined. This not only provides a more pleasing effect but it also is of great functional advantage to owners and operators of these rollers. Buffalo-Springfield distributors will supply additional details on these new models.

Lumetron Photoelectric Colorimeter for Water Analysis

This excellent instrument is particularly designed for color and turbidity measurements of water and for chemical water analysis. It is suitable for the sanitary examination of drinkable water as well as for quantitative chemistry of water for stationary boilers, railroads, chemical plants, industrial and municipal supply, sewage, and industrial wastes.

A very complete and highly valuable booklet gives detailed procedures for examination of samples and determination of water color, turbidity, and chemical analyses; color and turbidity of white sugar solutions; and color grading of lightly colored liquids. Write the Photovolt Corp., 95 Madison Ave., New York 16, N. Y., for your copy.

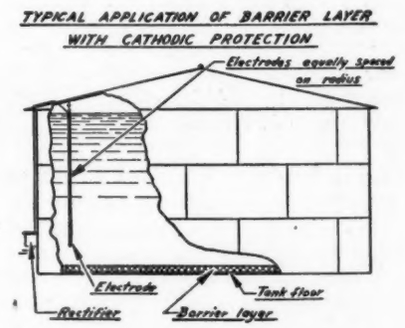


Lumetron photoelectric colorimeter.

The Lime Barrier with Cathodic Protection

In normal cathodic protection, the distribution of the corrective current to all submerged areas is obtained by means of number, size, length, and placement of electrodes. Areas not receiving sufficient current density will remain unprotected and continue to corrode.

Where the floor area is larger than the side wall area or is over 30 ft. in diameter, considerable savings in operating and maintenance costs of cathodic protection can be effected by a thin layer of sterilized limestone spread evenly over the floor area in lieu of using horizontal electrodes for this area. This need not be over ⅛ inch thick. With cathodic protection, it acts as a barrier against attack from the dissolved oxygen in the water on the exposed floor areas. The use of sterilized limestone, in this way, creates no objectionable character change in the water. The layer of limestone is semi-permanent. It has approval of State Boards of Health. Fuller information is available from Electro Rust-Proofing Corp., Dayton 10, Ohio.



Sketch showing lime barrier installation.

Huber variable weight tandem roller being loaded on a trailer.

Huber Variable Weight 3-4-Ton Tandem Roller

The new Huber variable weight tandem rollers weigh approximately 3 tons, but can be increased to more than 4 tons by the addition of water ballast. The engine is a V-type, four cylinder, air-cooled one that uses gasoline for fuel. Two forward and two reverse speeds (low, 2.6 mph; high, 4.4 mph)

are obtained through special forward and reverse clutches. All operating levers are within easy reach of the operator, and both the steering roll and the compression roll are equipped with rust-resisting sprinkler pipes, gravity-fed from a large water supply tank. Anti-friction bearings are used wherever wear is likely to occur.

Some of the overall dimensions of the Huber tandem are as follows: length 124″; width 48″; height 67″; height to top of water tank 51″; wheelbase 80″; and ground clearance under frame 10″.

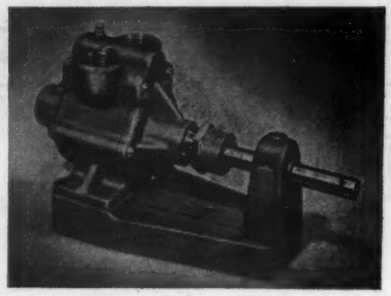
Electronic Communication for Water Works

The Long Beach, Calif., water department has installed a central communications system at their Wardlow plant which gives complete and immediate amplified-voice communication over the entire 25-acre area. The system consists of a master station and selector at the central desk, two trumpet speakers to cover the outside yard areas and eight substations. The illustration herewith shows the communications desk. This system has been highly valuable in making possible the very quick repair of leaks. Fuller information to meet your problems can be obtained from Executone, Inc., 415 Lexington Ave., New York 17, N. Y.

Executone installation at Long Beach.

Double Impeller Gearless 1″ Pump

A new double-impeller gearless pump, with standard one-inch connections and a built-in external driveshaft bearing and base, has been developed for the circulation of water, light oil, and other liquids by Eco Engineering Co., Dept. 94, 12 New York Ave., Newark, N. J. Designed to eliminate the most common causes of pump failure, gear jamming and stripping, the Eco pump employs double impellers made of several layers of a pressure-vulcanized, laminated material, and can pump equally well in either direction. These impellers pass sand, grit, filings, or sludge without stalling, jamming, or stripping and without damage to the bronze pump body, and are easily replaced when the six-screw face-plate is removed. The pumps can be mounted at any angle, and will pump in either direction. No adjustments or lubrication are needed, except on the external driveshaft bearing. The overall dimensions, with



Eco 1″ double impeller pump.

standard 1-inch connections and built-in driveshaft bearing and base are 10½″ x 4¼″ x 5¾″. Capacity varies from 7.5 gallons per minute at 600 rpm to 23 gallons per minute at 1,800 rpm.

Power Type Mower

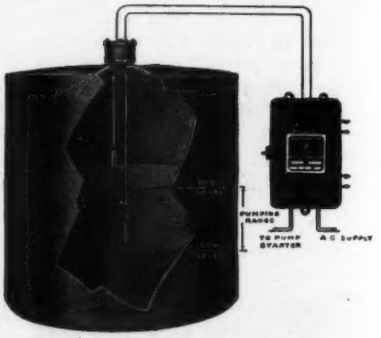
Power Development Co., 6719 Denison Ave., Cleveland 2, Ohio, announce a commercial type, power driven lawn mower, the "Kleen-kutter." This incorporates many new and attractive features; it is extremely mobile and easy to handle and will cut flush with fences, buildings and trees. It will cut anything from grass to heavy weed growth and can be set at cutting heights from ½″ to 3½″; only five minutes are required to make setting changes.

Whirling blade mower.

This mower is equipped with whirling blades whose rotary motion is parallel with the ground. The speed of this whirling motion, which is 3600 cutting strokes per minute, creates a suction, which makes grass and weeds stand perfectly upright, permitting them to be cut close and clean. The low platform construction of the unit also permits it to cut beneath hedges and shrubs without endangering their center trunks. It will cut a 24″ swath and will cut anything from lawn to heavy weed growth.

An Electrical Level Controller

The photoswitch level control can be used on all electrically conductive liquids. Contact with the liquid is only by stainless steel probe rods, and is made or broken by the rise or fall of the liquid.



How the Photoswitch works.

There are no floats, bellows or stuffing boxes. The contact controls a power circuit which actuates signals, valves or pumps. For more data ask for Bulletin 201-P. Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass.

How Much to Load Your Trucks

A new point system for rating the full carrying capacities of International trucks under all operating conditions has just been developed by the International Harvester Co. This system makes possible an accurate calculation of the extra load any International may carry where operating conditions are better than those on which the G.V.W. rating has been calculated.

Five fatigue factors are employed to calculate the extra load. Each factor is rated separately. The five are then to-

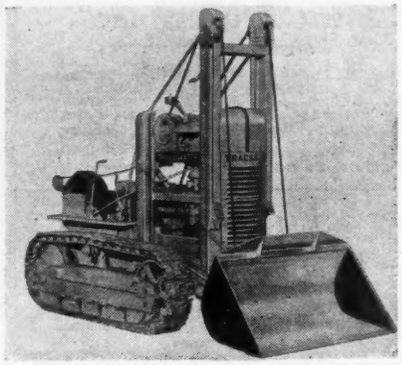
The first four International heavy duty "Western" model trucks produced at IHC Emeryville, Calif., plant.

taled to furnish the key to the truck's performance ability under the load, road, grade and other conditions it will encounter.

The International Point Rating System was developed by S. Colacuori, International sales engineer. It has been published as a sales engineering bulletin and distributed to all International truck branches and dealers.

New Trackson Traxcavator

Trackson Company announces the addition of a new model, "Traxcavator," the IT4, which mounts on and is powered by the "Caterpillar" Model D4 track-type tractor. The standard bucket is one yard, and is designed for digging, excavating, grading, loading, ma-



New Trackson Excavator.

terial handling and other general uses. The bucket is wider than the tractor tracks so that it will trim close alongside curbs and walls, trim side walls and corners of excavations neatly and maintain grades. This unit is claimed to be able to dump directly into trucks or carry its loads, cast, spread, or stockpile as desired; also ditch, cast, carry, spread, strip, bulldoze, backfill, level, landscape, terrace, remove snow, etc. A bulldozer blade can be installed in place of bucket; other attachments are available. The tractor drawbar is always free for hauling work.

Pressuregraph to Indicate Engine or Pump Performance

The new Pressuregraph provides, with a cathode ray oscillograph, a substantially linear pressure-time curve on a screen, which indicates the performance of any engine, pump, or other device subject to pressure variations. It is used for studies of all types of internal combustion engines, pumps, compressors, air and liquid pipe lines, etc. It shows instantly the erratic operation of a device which normally cannot be observed by other means, due to inertia of flywheels, and other factors. In addition to dynamic pressure variations, it shows static or slow pressure variations. It covers all mechanical speeds, and pressures up to 10,000 p.s.i. There is no appreciable inertia to overcome in the electronic driving mechanism. Operation is simple. Further details may be had by addressing: Electro Products Laboratories, 349 West Randolph St., Chicago 6, Ill.

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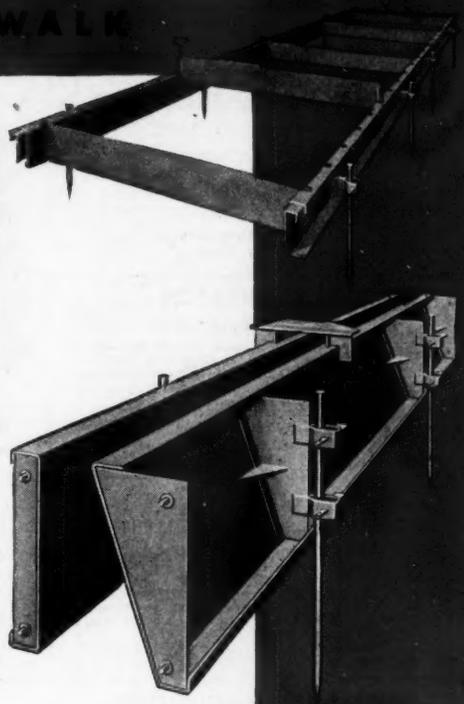

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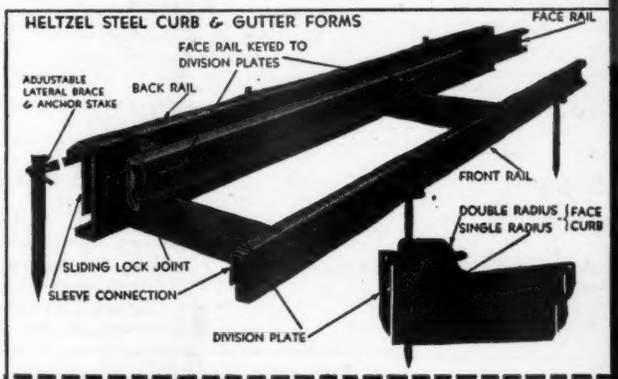

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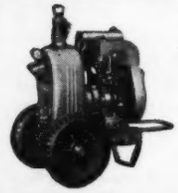
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NEWS OF PEOPLE

Frank Elder, formerly colonel, Sanitary Corps, has joined the staff of the American Public Health Association as sanitary engineer.

Robert N. Clark, formerly lieutenant colonel, Sanitary Corps, has been appointed chief sanitary engineer for the Tennessee Valley Authority, and will make his headquarters in Chattanooga.

Olaf L. Stokstad, lieutenant colonel, Corps of Engineers, and former soils engineer of the Michigan State Highway Department, has been awarded the Army Commendation Ribbon and citation for his work as soils engineer of the Detroit Engineer District.

H. L. Beohner has been appointed

H. L. Beohner, left, and A. D. Way of Permutit.

technical manager and *A. D. Way* chief mechanical engineer of the Permutit Co., New York City.

Charles W. Perelle, formerly vice-president in charge of manufacturing of Consolidated-Vultee Aircraft Corp., has been elected president of Gar Wood Industries, Inc.,

S. B. Applebaum, H. L. Tiger and *Norman E. Brice* have resigned from the Permutit Co., with which they have been connected for nearly 30 years, and have organized a new company, the Liquid Conditioning Corp., which will operate in the field of water conditioning for industrial, municipal, railroad and household use. Their offices are now at 423 West 126th St., New York.

W. A. Moggio, formerly major, Sanitary Corps, has been appointed field engineer, Southern and South Central regions, by the National Council for Stream Improvement.

Col. Arthur V. Harrington, Major Raymond Clary, Sn. C., *Major John Bellizia,* Sn. C., and *Capt. John Cassaza,* Sn. C., have returned to the Sanitary Engineering Division of the Massachusetts Dept. of Public Health.

William E. Dickinson, former Navy lieutenant, has been appointed to the staff of the Calcium Chloride Association. Mr. Dickinson is a civil engineering graduate of Ohio State and has had engineering experience both before and during his four years in the Navy.

W. Martin Johnson, former lieutenant colonel, Sanitary Corps, and *E. B. Boynton,* former lieutenant colonel, Corps of Engineers, have returned to Wiley & Wilson, consulting engineers, Lynchburg and Richmond, Va.

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BOOKLETS

3-Wheel Rollers.—A new 16-page catalog describes Buffalo-Springfield's 10-ton and 12-ton three-wheel rollers. Illustrations show clearly the mechanical parts. Specifications are included. Copies of the catalog may be secured from the Buffalo-Springfield Roller Company, Springfield, Ohio.

Sludge Filter.—A four-page bulletin describing the Conkey rotary disc vacuum filter, which provides design and many operating advantages, has just been issued by General American Transportation Corp., 420 Lexington Avenue, New York 17, N. Y. The folder contains information on the applications, operation, construction, auxiliary equipment, standard sizes, weights and dimensions applicable to this filter.

"Destroy Weeds with Flame Guns" is a new booklet (No. 2028) issued by Hauck Mfg. Co., 124-136 Tenth St., Brooklyn, N. Y. This 24-page book is a valuable manual on the subject, with lots of practical information. Sent on request.

Electric Tool Equipment, including portable electric hammers, drills, screwdrivers, nut runners, grinders, sanders and semi-portable hack saws are described in Catalog 464, Syntron Co., Homer City, Pa.

Sewage Equipment.—Johns-Manville has compiled a two-part 78-page booklet, "Products for the Sewage Works Industry." Part one contains over 100 photographs of actual installations of the many Johns-Manville asbestos products in sewage systems and treatment plants throughout the country. Each photograph is identified and located by name in the captions. Typical of the many applications included are: Insulation for digesters, boilers, steam and hot water lines, sludge incinerators and furnaces; packings for sewage and sludge pumps; gasketing for chlorinator piping; Transite ventilators on digester control vaults; Transite sewer pipe for gravity lines; Transite pressure pipe for force mains; Transite "S" pipe for venting gases, vapors, etc.; Asbestos-Ebony control panels and instrument boards in treatment plants; Chemstone for gates in settling tanks and for table tops in laboratories; Transite sheets for building construction; acoustical materials for noise control in laboratories, offices and pump rooms; roofing and shingles for administration buildings, digesters, filter houses, etc.; waterproofing materials for sludge tanks; and refractories for sludge incinerators and air preheaters. Part two is a catalogue containing descriptions of the illustrated Johns-Manville products with further information regarding their use. Copies may be obtained by writing Johns-Manville, Box 290, New York 16, N. Y.

Readers' Service Department

***These booklets are FREE but distribution is restricted to those actively engaged in engineering or construction. Use the coupon or write the manufacturer direct, mentioning* PUBLIC WORKS**

Construction Materials and Equipment

Air Compressors

1. LeRoi Portable compressors in sizes from 60 to 500 c.f.m., gasoline or Diesel powered on mountings to fit your special needs. Same manufacturer makes both compressor and engine. Complete bulletin. Write LeRoi Company, 1770 So. 68th St., Milwaukee 14, Wis.

2. Jaeger air compressors, made in sizes 60 to 500 cu. ft.; trailer, truck, tractor and stationary mounted, gas, Diesel and electric power. Catalog and data. The Jaeger Machine Co., 400 Dublin Av., Columbus 16, O.

Resurfacing Plants

15. Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

16. Moto-paver is a new type self-contained travelling asphalt plant having a capacity of 100 to 120 tons per hour. A novel spreading and laying device permits quick change to various road widths and crown conditions and thicknesses. Write Hetherington & Berner, 729 Kentucky Ave., Indianapolis 7, Ind. for Bulletin MP46 which gives full descriptions and specifications.

Concrete, Early Strength

38. 64-page manual tells how to speed concreting, to secure high early strength and greater workability at temperatures either below or above freezing. 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit 26, Mich.

Concrete, More Durable

50. How cement dispersion assures improved concrete with impressive economies in initial construction costs and maintenance costs. Manual from The Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.

Drainage Products

70. Standard corruguated pipe, perforated pipe and MULTI-PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses. 48-page booklet, No. 12. Armco Drainage Products Association, Middletown, Ohio.

72. New data on clay pipe is contained in literature offered by National Clay Pipe Manufacturers Inc. Address them at 111 W. Washington St., Chicago 2, Ill.

Forms, Curb and Gutter

78. Curb and Gutter and Sidewalk Forms, including battered face curb form especially for modern traffic conditions. Heltzel Steel Form & Iron Co., Warren, O., will send booklets on request.

Generators

80. Two portable generators, one for AC and the other for DC current are described in new bulletin issued by Homelite Corp., Port Chester, N. Y. Commonly used for operating electrical equipment in planes, tanks and trucks, or to charge batteries or to supplement batteries for starting main engines, etc.

Graders, Patrol

98. The Austin-Western 99M Power Grader with its powerful all wheel drive handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow ploughing, loading, mixing, bulldozing, shoulder trenching and backsloping. Write for Bulletin 1946. Austin-Western Co., Aurora, Ill.

Joints, Expansion

102. Para-Plastic hot-poured rubber joint sealing compounds and Asphalt, Fibre, Cork, Cork-Rubber, Sponge Rubber and Waterstop expansion joints are described and illustrated. Write Servicised Products Corporation, 6051 W. 65th St., Chicago 38, for a copy.

Mud-Jack Method

107. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee 10, Wis.

Paving Breakers

110. Powerful self-contained gasoline hammers illustrated. Used as paving breakers and spike drivers. Easily portable, economical. Write Syntron Co., Box 220, Homer City, Pa.

Paving Materials, Bituminous

111. New "Tarvia Manual" is packed with useful data on how to build and maintain roads with Tarvia. Each step is illustrated with excellent action pictures, 64 pp. 103 illus. Write to The Barrett Div., 40 Rector St., New York 6, N. Y.

Pumps

117. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

119. "Carter Self-priming Centrifugal Pumps," a new 12-page illustrated catalog, gives detailed description of construction, and includes complete information on pump sizes, ratings and dimensions. Ask for bulletin #4310. Address: Ralph B. Carter Co., Hackensack, N. J.

122. Pump Bulletin L-501 just out, gives latest illustrated information on Homelite gasoline engine driven portable pumps. Write Homelite Corp., Port Chester, N. Y.

Road Building and Maintenance

126. Two and Four Wheel Scrapers, Bulldozers, Tamping Rollers, Winches, Hoists and Repair Towers are subject of special bulletins issued by Gar Wood Industries, 7924 Riopelle St., Detroit 11, Mich.

128. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

130. BG Maintainer, a powerful speedy, low-priced machine for light road maintenance. Write for folder, Huber Mfg. Co., Marion, Ohio.

Rollers

141. Three-Wheel and Tandem Rollers, 5 to 8-ton and 10 & 12 ton sizes: also variable weight tandem roller for new highway surfacing and old road conditioning. Huber Mfg. Co., Marion Ohio.

Soil Stabilization

150. "High-Service, Low Cost Roads" sets forth the principles and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated, 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

152. Complete information dealing with Calcium Chloride Stabilized Roads. Contains many charts, tables and useful information. Write Columbia Chemical Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19, Pa.

154. "Soil Stabilization with Tarvia" —An illustrated booklet describing the steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Division, 40 Rector St., New York 6, N. Y.

Surface Consolidation and Maintenance

188. How sub-soils can be conditioned to resist softening and frost-action; how surfacing can be consolidated to provide smooth all-weather riding surfaces; how they can be maintained so as to prevent disintegration and gravel loss. Write the Calcium Chloride Association, Penobscot Bldg., Detroit 26, Mich., for Bulletin No. 29.

Tractors

190. International Diesel Tractors are described and many uses mentioned in 48-page catalog. Write International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

192. Little Giant Tractor Sweepers for streets are described in illustrated bulletin. Especially designed to meet the needs of smaller cities and towns. Address: Little Giant Products, Inc., 1554 N. Adams St., Peoria 3, Ill.

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200. 1-, 2-, 5-Ton Little Giant Hand Winches take the labor out of any heavy operation. Outstanding design and construction. Address: Little Giant Products, Inc., Peoria 3, Ill.

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290. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

Snow Fighting

Snow Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

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Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Activation and Aeration

367. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability, 20 pp. illustrated. Sent on request to Norton Company, Worcester 6, Mass.

Bodies, Refuse

375. Gar Wood special bodies for sanitary refuse collection and for street sprinkling are illustrated and described in a new catalog issued by Gar Wood Industries. 7924 Riopelle St., Detroit, Mich.

Cleaning Sewers With Own Forces

385. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

386. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boulevard, Los Angeles 34, Calif.

387. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Three sizes of machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana.

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388. Literature on Flexible method of cleaning water mains any size from 2" to 72", giving full details and list of nearest representatives in all parts of country. Address: Flexible Underground Pipe Cleaning Co., 9059 Venice Blvd., Los Angeles, Calif.

Corrosion Prevention, Water Tanks

389. For all water tank maintenance troubles, whether the need is for repairs, painting, welding, or cleaning, get latest literature of Chicago Tank and Bridge Co., 618 Empire Bldg., Rockford, Ill.

390. "Preventing Corrosion of Steel Water Storage Tanks" is the subject of an interesting, illustrated bulletin issued by Electric Rust-Proofing Corp., Dayton 10, Ohio. Gives full description of Rustop System of prevention.

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391. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. The American Brass Company, 25 Broadway, New York.

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392. 20-page catalog describes "Dieselectric" plants 3 to 10 KVA, and diesel engines from 4 to 12 H.P. These are easily transported and will produce reliable, low cost light and power anywhere. Write WITTE ENGINE WORKS, Division of Oil Well Supply Company, Kansas City 3, Mo.

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399. Feeders of all types including Hypochlorinators, Reagent Feeders, Dry Chemical Feeders, Chlorinators and Ammoniators for feeding all of the usual chemicals used in sanitation practice—manufactured by Wallace & Tiernan Co., Newark 1, N. J.

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401. Gravimetric Feeder, Loss-in-weight type, measures and feeds dry or liquid materials by weight. Illustrated bulletin. Omega Machine Co., Inc., 96 Codding St., Providence 1, R. I.

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409. The primary devices for flow measurement—the orifice, the pitot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (No. 300). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Gas Holders

412. A 16-page bulletin gives detailed information on the development of corrosion—and how to combat it—in gas holders. A copy will be mailed on request to The Stacey Bros. Gas Construction Company, 5535 Vine St., Cincinnati 16, Ohio.

Gates, Valves, Hydrants

413. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

Generating Sets, Diesel

420. Le Roi engine-generator units for operating on "no cost" sewage gas are fully described and illustrated in new bulletins now available. Address Le Roi Co., 1726 S. 68th St., Milwaukee 14, Wis.

422. New booklet describes Sheppard Diesel Generating Sets that make low cost electricity from cheap fuel and give dependable service in the hands of any average operator. Write R. H. Sheppard Co., 250 Middle St., Hanover, Pa.

Laboratory Equipment

425. "Replaces 'old fashioned' Methyl Orange Indicator" is sub-title of new folder on pH control by new Fleisher Methyl-Purple Indicator. Sharp, clear and positive end points of green and purple insures more accurate and quicker results. Issued by Fleisher Chemical Co., Benjamin Franklin Station, Washington 4, D. C.

Leak and Pipe Location

426. Leak Locators. Again available to waterworks superintendents, the Globe line of leak locators, dipping needles and pipe finders. Several leaflets describing the original Geophone leak locator, Little Wonder pipe phone, and the Magnetite Dipping Needle. Globe Phone Mfg. Corp., Reading, Mass.

427. For tracing buried pipes and finding hidden leaks get detail of Allen-Howe Leak Detectors, Pipe Locators, Dipping Needle and Pipe Phones. Write Allen-Howe Electronics Corp., 150 Main St., Peabody, Mass.

Manhole Covers and Inlets

429. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul, and Indiana Ave., South Bend 23, Ind.

Meter Setting and Testing

431. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Meters, Venturi

432. New bulletin illustrates Builders Air Relay system for liquids containmg suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. "The Selection of Main Line Meters," a highly informative and useful presentation, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

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434. "Watchdog" water meters, made in standard capacities from 20 GPM up; frost-proof or split case in household sizes. All parts interchangeable with present models of same manufacturer. For bulletins, write Worthington-Gamon Meter Co., Harrison, N. J.

Pipe, Cast Iron

437. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

438. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Pipe, Lock Joint

442. Lock Joint Reinforced Concrete Sewer Pipe, Pressure Pipe, Culvert Pipe, Centrifugal Pipe and Subaqueous Pipe is described and illustrated in bulletins available from Lock Joint Pipe Co., Ampere, N. J.

Pipe Pusher

444. One-man-operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117, Greenlee Tool Co., 2042 Columbia Ave., Rockford, Ill.

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Pipe Joints, Sewer

447. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Adams, Mass.

Pipe Joint Compounds

450. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Pumps, Sludge

451. Plunger Sludge Pumps are described in bulletin #4502, just released for publication. This new eight-page catalog shows detail photos of construction of a Carter unit, and gives complete information including specifications, motor selection, capacities, dimensions, weights and sizes of the various single and multiple plunger pumping sets manufactured by the Ralph B. Carter Co., Hackensack, N. J.

Pumps and Well Water Systems

454. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis 8, Tenn.

455. Peerless deep well pumps in a variety of types, with oil or water lubrication and any power drive, to pump water from any depth. Write Peerless Pump Div., Food Machinery Corp., 301 W Ave. at 26th St., Los Angeles 31, Calif.

456. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.

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459. For saving trucks, labor, and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Brothers, Inc., Knoxville 17, Tenn.

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460. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and inclined types). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

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462. "Disposal of Community Refuse by Incineration" is a handsome 34-page booklet that discusses incineration from a commonsense standpoint. Illustrated by numerous photos of typical installations and includes diagrammatic outlines of various plant designs. Write Morse Boulger Destructor Co., 207-P East 42nd St., New York 17, N. Y.

463. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

Softening

466. This folder explains the process of Zeolite water softening and describes and illustrates the full line of equipment for that purpose made by the Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill. Includes flow charts, tables and other valuable data. Write for a copy of this instructive folder.

467. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in a technical booklet. Permutit Co., 330 W. 42nd St., New York 18, N. Y.

Sprinkling Filters

469. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Swimming Pools

472. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Taste and Odor Control

474. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination. Sent free to any operator requesting it.

Treatment

477. The Yeomans "Package" Aerifier" plant is especially designed for communities up to 3,000 population. This attractive, efficient plant, which features mechanically combined aeration and final clarification in a single tank, is described in Bulletin 6650. Write Yeomans Brothers Company, 1425 North Dayton Street, Chicago 22, Ill.

480. Booklet No. 1642 on Link-Belt Circuline Collectors contains sanitary engineering data and design details. Catalog No. 1742 on Straightline Collectors, contains layout drawings, installation pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

486. 28-page catalog describes and illustrates the Dorrco Hydro-Treator, a self-contained water treatment unit combining Flocculation, Sludge Thickening and Clarification. Reduces treatment time and lowers plant construction costs. The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

488. "Packaged" Sewage Treatment Plants specifically developed for small communities — 100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2438 Wolfram St., Chicago 18, Ill.

489. Illustrated and described in detail in this bulletin, the new Carter Improved Flocer presents an entirely new method of controlled flocculation without paddle agitation. Write Ralph B. Carter Co., Hackensack, N. J.

490. New bulletin fully describes and illustrates Hardinge sludge collectors for clarifiers, sludge concentration and skimming in both circular and rectangular tanks. Write Hardinge Company, Inc., York, Pa.

Water Treatment

496. "Use of copper sulphate in water treatment plants" contains valuable data on chemicals, dosage, etc. Ferri-floc Ferric Sulphate—a new, valuable booklet on coagulation for water and sewage treatment plants. Write Tennessee Corporation, Atlanta 1, Ga.

502. Alum for coagulation in both sewage and water plants is the subject of literature now available from General Chemical Company, 40 Rector St., New York 6, N. Y.

503. Get your illustrated booklet now on *Pittchlor*, a high test calcium hypochlorite, containing minimum 70% of available chlorine. Address, Pittsburgh Plate Glass Co., Columbia Chemical Div., 5th Ave. at Bellefield, Pittsburgh 13, Pa.

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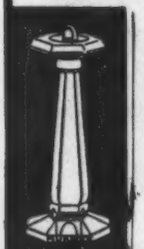

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Metcalf & Eddy 60
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Weston, L. A. 32
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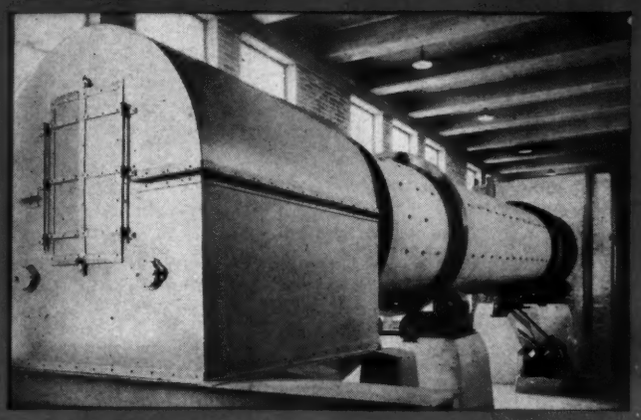
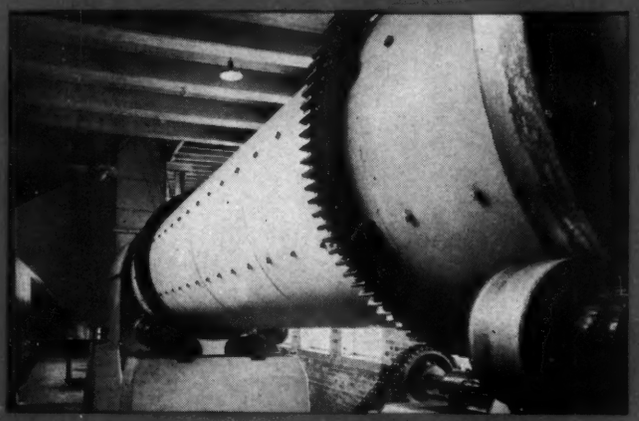
Wood Co., R. D. 44
Worthington Gamon Meter Co. 8

Yeomans Brothers Co. 16

General American Louisville
ROTARY DRYERS





Louisville Rotary Dryers, as designed and built by General American, offer a continuous, efficient and economical means of drying municipal wastes such as sludges, screening and garbage.

In all Louisville Rotary Dryers, the material to be dried is fed continuously into one end of the dryer cylinder, is tumbled in either direct or indirect contact with the heating medium and discharge — also continuously, and at the desired dryness, — from the opposite end of the machine.

General American maintains laboratories and pilot plants in order to determine and recommend the correct type of drying equipment. In some instances, entirely new drying techniques have been developed for materials which have formerly baffled all attempts to rotary continuous drying.

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Turbo-Mixers
Sludge Filters
Tanks • *Stacks*

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Help Clean up Recreation Spots with

EFFLUENT CHLORINATION

Is your community hanging out the "Tourist Welcome" sign this year? If so — if you want to help bring that extra income to your locality — make sure that the recreation areas are ready for them. Those downstream bathing and fishing spots can be best protected — for vacationers and the hometown folks alike — by adequate effluent chlorination. And that's where dependable W & T chlorinators for every sewage plant need can take a big load off your mind.

The installation your W & T representative will be glad to help you plan to safeguard amusement areas can often "carry its weight" on other treatment jobs too.

"The Only Safe Sewage is a Sterilized Sewage"

WALLACE & TIERNAN
COMPANY, INC.

MANUFACTURERS OF CHLORINE AND AMMONIA CONTROL APPARATUS

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